National Park Service
U.S. Department of the Interior

Lake Roosevelt National Recreation Area
Washington

LAKE ROOSEVELT
NATIONAL RECREATION AREA

Personal Watercraft Use
Environmental Assessment

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April 2003

SUMMARY

Lake Roosevelt National Recreation Area was established in 1946 following the Secretary of the Interior's approval of a Tri-Party Agreement among the National Park Service (NPS), the Bureau of Reclamation, and the Bureau of Indian Affairs. The park is dedicated to conserving the natural and cultural resources and recreational and scenic values of Lake Roosevelt for the enjoyment, education, and inspiration of the more than one million visitors that visit the recreation area annually.

The purpose of and the need for taking action is to evaluate a range of alternatives and strategies for managing personal watercraft (PWC) use at Lake Roosevelt National Recreation Area to ensure the protection of park resources and values while offering recreational opportunities as provided for in the national recreation area's authorizing memorandum of agreement, purpose, mission, and goals. Upon completion of this process, in accordance with the *National Environmental Policy Act* (NEPA), the National Park Service may either take action to adopt special regulations to manage PWC use, or it may not reinstate PWC use at this park unit.

BACKGROUND

More than one million personal watercraft are estimated to be in operation today in the United States. Sometimes referred to as "jet skis" or "wet bikes," these vessels use an inboard, internal combustion engine powering a water jet pump as its primary source of propulsion. They are used for enjoyment, particularly for touring and maneuvers such as wave jumping, and they are capable of speeds in the 60 mile-per-hour (mph) range. Personal watercraft were once the fastest growing segment of the boating industry and represented over one-third of total sales. National PWC ownership increased every year between 1991 and 1998; the rate of annual increase peaked in 1994 at 32% and dropped slightly in 1999, 2000, and 2001. While PWC use remains a relatively new recreational activity, it has occurred in 32 of the 87 national park system units that allow motorized watercraft.

After studies in Everglades National Park showed that PWC use resulted in damage to vegetation, adversely impacted shorebirds, and disturbed the life cycles of other wildlife, the NPS prohibited PWC use by a special regulation at the park in 1994. In recognition of its duties under its *Organic Act* and NPS *Management Policies,* as well as increased awareness and public controversy about PWC use, the NPS subsequently reevaluated its methods of PWC regulation. Historically, the National Park Service had grouped personal watercraft with all vessels; thus, PWC use was allowed when the unit's superintendent's compendium allowed the use of other vessels. Later, the National Park Service closed seven units to PWC use through the implementation of horsepower restrictions, general management plan revisions, and park-specific regulations such as those promulgated by Everglades National Park.

In May 1998, the Bluewater Network filed a petition urging the National Park Service to initiate a rulemaking process to prohibit PWC use throughout the national park system. In response to the petition, the National Park Service issued an interim management policy requiring superintendents of parks where PWC use can occur but had not yet occurred to close the unit to such use until the rule was finalized. The National Park Service envisioned the servicewide regulation as an opportunity to evaluate impacts from PWC use before authorizing the use. On March 21, 2000, the National Park Service issued a regulation prohibiting PWC use in most units and required 21 units to determine the appropriateness of continued PWC use.

In response to the PWC final regulation, Bluewater Network sued the National Park Service, challenging the NPS decision to allow continued PWC use in 21 units while prohibiting PWC use in other units. In response to the suit, the National Park Service and the environmental group negotiated a settlement. Each

park desiring to continue long-term PWC use must promulgate a park-specific special regulation in 2002. In addition, the settlement stipulates that the National Park Service must base its decision to issue a park-specific special regulation to continue PWC use through an environmental analysis conducted in accordance with NEPA. The NEPA analysis at a minimum, according to the settlement, must evaluate PWC impacts on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety.

As the settlement deadline approached and the park units were preparing to prohibit PWC use, the National Park Service, Congress, and PWC user groups sought legal methods to keep the parks open to this activity. However, no method was successful. On November 6, 2002, Lake Roosevelt National Recreation Area was closed to PWC use. If, as a result of this environmental assessment, an alternative is selected that would allow PWC use to be reinstated, then a special regulation to authorize that use will be drafted.

ALTERNATIVES CONSIDERED

This environmental assessment evaluates three alternatives concerning the use of personal watercraft at Lake Roosevelt National Recreation Area.

- Alternative A would reinstate PWC use under a special NPS regulation as previously managed.
- Alternative B would reinstate PWC use under a special NPS regulation with additional management prescriptions. (The park has identified alternative B as the preferred alternative.)
- The no-action alternative would continue the prohibition of PWC use on NPS-managed waters of Lake Roosevelt.

Based on the environmental analysis prepared for PWC use at the recreation area, alternative B is considered the environmentally preferred alternative because it would best fulfill park responsibilities to ensure safe, healthful, productive, and aesthetically and culturally pleasing surroundings; protect sensitive habitat; and attain a wider range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.

ENVIRONMENTAL CONSEQUENCES

Impacts of the three PWC management alternatives were assessed in accordance with *Director's Order #12: Conservation Planning, Environmental Impact Analysis and Decision-Making.* The *Director's Order #12 Handbook* requires that impacts to park resources be analyzed in terms of their context, duration, and intensity. It is crucial for the public and decision-makers to understand the implications of those impacts in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists.

To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the PWC management alternatives. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial.

Each PWC management alternative was compared to a baseline to determine the context, duration, and intensity of resource impacts. The baseline, for purposes of impact analysis, is the reinstatement of PWC

use as managed prior to the November 2002 ban (alternative A). The impact analysis utilizes a projection of PWC use over the next 10 years. Table A summarizes the results of the impact analysis for the impact topics that were assessed in the “Environmental Consequences” chapter.

TABLE A: SUMMARY OF THE IMPACT ANALYSIS

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Water Quality	PWC use impacts: Negligible adverse effects in 2002 and 2012 based on ecotoxicological threshold volumes. Adverse water quality impacts from benzo(a)pyrene, benzene and MTBE based on human health (ingestion of water and fish) benchmarks would be negligible in both 2002 and 2012, based on EPA and state of Washington water quality criteria. Cumulative impacts: Impacts from personal watercraft and motorized boats would be negligible, adverse, and long-term for benzo(a)pyrene, benzene and MTBE, and would apply to both NPS- and tribal-managed waters.	PWC use impacts: Same as alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: Pollutant loads to NPS-managed waters from personal watercraft would be eliminated. Cumulative impacts: PWC contribution to cumulative impacts on NPS-managed waters would be eliminated. Impacts from other watercraft would be negligible, adverse, and long-term. Negligible cumulative impacts to tribal-managed waters would include impacts from PWC use and other watercraft.
Air Quality	PWC use impacts: Negligible adverse impacts to human heath related to the PWC airborne pollutants HC, PM_{10} and NO_x, and minor adverse impacts from CO for the year 2002. The risk from PAH would also be negligible. In 2012, there would be a negligible increase in NO_x emissions and a decrease in emissions of the other pollutants, although the impact level for these pollutants would remain the same as in 2002. Cumulative impacts: Negligible for PM_{10}, and moderate for HC and CO in 2002 and 2012. NO_x emissions would be negligible in 2002 and minor in 2012. Although there would be an increase in NO_x emissions in 2012, the greater reduction in HC emissions would to result in a beneficial impact to regional ozone concentrations. All impacts would be long term and would apply to both NPS- and tribal-managed waters.	PWC use impacts: Same as alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: Beneficial impacts on human health for CO, HC, PM_{10} and NO_x, as well as the risk from PAH for 2002 and 2012 due to the elimination of PWC in the national recreation area. Cumulative impacts: PWC contribution to cumulative impacts would be eliminated. Other cumulative impacts in NPS-managed areas remain the same as in alternative A. PWC use continues to contribute to cumulative impacts in tribal-managed areas.

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Air Quality Related Values from PWC Pollutants	PWC use impacts: Negligible adverse impacts in 2002 and 2012 under alternative A. Cumulative impacts: Moderate adverse impacts in 2002 and 2012 to both NPS- and tribal-managed areas.	PWC use impacts: Same as alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: PWC emissions would be eliminated. Cumulative impacts: PWC contribution to cumulative impacts in NPS-managed areas would be eliminated. Other cumulative impacts in NPS-managed areas remain the same as in alternative A. PWC use continues to contribute to cumulative impacts in tribal-managed areas.
Soundscapes	PWC use impacts: Short-term minor to moderate adverse related to the number of personal watercraft operating as well as the sensitivity of other visitors. Cumulative impacts: Adverse noise impacts from personal watercraft and other watercraft, automobiles, aircraft, and lumber operations would be minor to moderate, and would predominate on busy days during the high use season. Impacts would be long-term because of the high volume of annual boating use. Cumulative impacts would be similar for both NPS and tribal-managed areas.	PWC use impacts: Flat-wake restrictions would have beneficial impacts to some park visitors within the national recreation area from reduced noise levels. Impact levels would be the same as alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: Noise would be decreased relative to other due to the elimination of PWC use within the national recreation area. There would be occasionally noticeable beneficial effects on the soundscape in some areas. There could be minor adverse effects in the park from increased PWC operation outside park boundaries. Cumulative impacts: Long-term, minor to moderate adverse impacts. Contribution to cumulative impacts from PWC use within the national recreation area would be eliminated.
Wildlife and Wildlife Habitat	PWC use impacts: Negligible to minor adverse impacts on fish, waterfowl, and other wildlife. Impacts would be short-term. Cumulative impacts: Short-term, minor adverse effects on wildlife and wildlife habitat from visitor activities. Lake operations would have minor to moderate adverse impacts to fish, and minor to moderate adverse impacts to riparian and wetland areas that provide habitat for wildlife. Cumulative impacts to tribal-managed wildlife resources would be similar to those for NPS-managed areas.	PWC use impacts: Beneficial impacts to wildlife due to the decreased noise and disturbance from personal watercraft and the ability to mitigate future impacts. Impact levels remain as in alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: Beneficial impacts due to the elimination of personal watercraft on park-managed waters. Cumulative impacts: PWC contribution would be eliminated within the national recreation area. Other cumulative impacts would be similar to alternative A. PWC use would continue to contribute to cumulative impacts in tribal-managed areas.

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Threatened and Endangered, and Special Concern Species	PWC use impacts: May affect, but unlikely to adversely affect federal or state listed or special concern species. Cumulative impacts: Visitor activities and lake operations may affect, but would not likely cause adverse effects to federal or state listed or special concern species.	PWC use impacts: Similar to alternative A except resource monitoring would have beneficial impacts. Cumulative impacts: Same as alternative A.	PWC use impacts: Potential for impacts to special status species within the national recreation area would be eliminated due to continuation of ban of personal watercraft on NPS-managed waters. Cumulative impacts: PWC contribution would be eliminated in national recreation area. Other cumulative impacts similar to alternative A. PWC use would continue to contribute to cumulative impacts in tribal-managed areas.
Shorelines and Shoreline Vegetation	PWC use impacts: Negligible adverse effects. Cumulative impacts: Negligible adverse impacts due to visitor activities and minor adverse impacts from wind-caused wave action and lake operations. Cumulative impacts would be similar on both NPS and tribal-managed shorelines.	PWC use impacts: Beneficial impacts to sensitive shoreline vegetation within the national recreation area over the short and long term due to future resource monitoring. Cumulative impacts: Same as alternative A.	PWC use impacts: Beneficial impacts from elimination of PWC use on NPS-managed waters. Cumulative impacts: Contribution from PWC use in national recreation area would be eliminated. Other cumulative impacts within the recreation area would be the same as in alternative A PWC use would continue to contribute to cumulative impacts in tribal-managed areas.
Visitor Use and Experience	PWC use impacts: Negligible to minor adverse impacts on experiences for most visitors in the short and long-term. Cumulative impacts: Negligible to minor short-term adverse impacts on visitor experience goals in both NPS- and tribal-managed areas due to visitor activities. Plans for future expansion or improvements to visitor facilities at within the national recreation area would have long-term beneficial impacts on visitor experience.	PWC use impacts: Same as alternative A for non-PWC users. Designation of the flat-wake zones within national recreation area waters would have negligible to minor adverse impacts on most PWC users and beneficial impacts on swimmers, water skiers, and other persons in the water. Cumulative impacts: Same as alternative A.	PWC use impacts: Beneficial impacts on the experiences of most non-PWC visitors using park-managed waters, and minor to moderate adverse impacts on visitors to tribal-managed waters due to increased crowding. Impacts on all PWC users would be long term, moderate, and adverse. Cumulative impacts: Negligible long-term adverse effect on PWC users at nearby water bodies that would potentially receive increased PWC use. Minor to moderate adverse impacts on visitors to tribal managed areas of Lake Roosevelt. Impacts related to non-PWC visitor activities and facility improvement plans would remain the same as alternative A.

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Visitor Conflicts and Safety	PWC use impacts: Negligible to minor adverse impacts on other boaters in the short and long term, minor to moderate adverse impacts related to conflicts and safety of swimmers, and negligible to minor adverse impacts on other shoreline visitors particularly in the noted high PWC use locations. Cumulative impacts: Minor adverse impacts from all user groups in the short and long term, particularly near the high-use areas. Cumulative impacts in other areas of the lake would be negligible. Cumulative impacts to visitors of tribal managed facilities would be similar. Cumulative impacts due to facilities improvements would be beneficial to national recreation area visitors.	PWC use impacts: Short- and long-term beneficial impacts on visitor conflicts and safety of other visitors near the designated swim areas, boat launches and marinas, and campgrounds of Lake Roosevelt National Recreation Area. Cumulative impacts: Same as alternative A.	PWC use impacts: Long-term beneficial impacts on NPS-managed waters. Long-term minor to moderate adverse impacts on tribal-managed waters. Cumulative impacts: PWC contribution to cumulative impacts within the national recreation area would be eliminated. Minor to moderate adverse impacts on visitors to tribal managed areas of Lake Roosevelt.
Cultural Resources	PWC use impacts: Minor adverse impacts on listed or potentially listed archeological sites from possible illegal collection and vandalism or erosion. Cumulative impacts: Minor to major adverse, due to the number of visitors and the potential for illegal collection or destruction. Fluctuations in water levels could have minor to moderate adverse impacts to listed or potentially listed archeological sites from erosion. Cumulative impacts would be similar to archeological resources managed by the tribes. Impacts would occur over the short- and long-term	PWC use impacts: Minor beneficial impact from flat-wake zoning, but impact levels same as alternative A. Cumulative impacts: Same as alternative A.	PWC use impacts: Minor beneficial impacts over the short and long term due to lack of PWC use in NPS-managed waters. Cumulative impacts: PWC contribution eliminated on NPS-managed waters. Other cumulative impacts the same as in alternative A. PWC use would continue to contribute to cumulative impacts on tribal managed resources.

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Socioeconomic Effects	No change in consumer surplus for PWC users or other visitors. No change in producer surplus to providers of PWC or non-PWC services. No change in welfare to local residents or the general public.	No change in consumer surplus for PWC users. Slight increase in consumer surplus of non PWC visitors. No change in producer surplus of providers of PWC services and slight increase in producer surplus for providers of non-PWC services. No change in welfare to local residents. Slight increase in welfare of the general public.	Decrease in consumer surplus for current and future PWC users. Increases in consumer surplus for non-PWC visitors. Decrease in producer surplus for PWC rental and retail shops. No change in producer surplus for hospitality services. Increase in producer surplus for providers of services to non-PWC park visitors. Increase in welfare to the general public and local residents who do not use PWC. Decrease in welfare to local residents who use PWC.
Environmental Justice	There would be no adverse effects related to environmental justice since reinstating PWC use would not disproportionately affect minority or low income populations.	Same as alternative A.	Negligible to minor adverse impact on tribal enforcement costs. Beneficial impacts could result from PWC users' increased spending at tribal facilities. Long-term negligible to minor adverse impact to tribal managed lands and waters. Minor to moderate adverse impacts to marinas on NPS-managed lands that are managed by the tribal entities.
National Recreation Area Management and Operations			
Conflicts with State and Local Regulations	Negligible impacts since no conflicts with state or tribal regulations would occur.	Same as alternative A.	Minor to moderate adverse impacts would occur due to conflict with tribal policies on Lake Roosevelt. No conflict with other state or local regulations or policies.
Impact to Park Operations from Increased Enforcement Needs	Negligible impacts.	Negligible to minor adverse impacts on park operations from increased enforcement efforts needed to implement flat-wake zoning and educational efforts.	Minor to moderate impacts on park operations due to a need for additional enforcement efforts associated with the ban on personal watercraft.

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PURPOSE OF AND NEED FOR ACTION

Lake Roosevelt National Recreation Area is located in northeast Washington. The recreation area includes a 154-mile-long reservoir that was formed when the waters of the Columbia River were impounded behind the Grand Coulee Dam (1933–1942). The recreation area was established in 1946 following the Secretary of the Interior's approval of a Tri-Party Agreement among the National Park Service, the Bureau of Reclamation, and the Bureau of Indian Affairs. The reservoir extends from the dam site at Grand Coulee, Washington, to near the Canadian border (map 1). At full pool, the surface area of the reservoir is about 81,389 acres, and the total shoreline is about 513 miles. The recreation area averages approximately 1.4 million visitors a year who participate in camping, swimming, fishing, water skiing, and general boating, including personal watercraft[1] (PWC) use.

More than one million personal watercraft are estimated to be in operation today in the United States. Sometimes referred to as "jet skis" or "wet bikes," these vessels use an inboard, internal combustion engine powering a water jet pump as its primary source of propulsion. They are used for enjoyment, particularly for touring and maneuvers such as wave jumping, and they are capable of speeds in the range of 60 miles per hour (mph). The Personal Watercraft Industry Association believes that through the 2002 model year the output on a limited number of higher rated models was around 155 and 165 hp (PWIA 2002b).

The National Park Service maintains that PWC use emerged and gained popularity in park units before it could initiate and complete a "full evaluation of the possible impacts and ramifications." While PWC use remains a relatively new recreational activity, it has occurred in 32 of 87 park units that allow motorized boating.

The National Park Service first began to study personal watercraft in Everglades National Park. The studies showed that PWC use over emergent vegetation, shallow grass flats, and mud flats commonly used by feeding shore birds damaged the vegetation, adversely impacted the shore birds, and disturbed the life cycles of other wildlife. Consequently, managers at Everglades determined that PWC use remained inconsistent with the resources, values, and purposes for which the park was established. In 1994, the National Park Service prohibited personal watercraft by a special regulation at the park (59 FR 58781).

Other public entities have taken steps to limit, and even to ban, PWC use in certain waterways as national researchers study more about the effects of PWC use. At least 34 states have either implemented or have considered regulating the use and operation of personal watercraft (63 FR at 49314). Similarly, various federal agencies, including the Fish and Wildlife Service and the National Oceanic and Atmospheric Agency, have managed personal watercraft differently than other classes of motorized watercraft.

Specifically, the National Oceanic and Atmospheric Agency regulates the use of personal watercraft in most national marine sanctuaries. The regulation resulted in a court case where the Court of Appeals for the District of Columbia declared such PWC-specific management valid. In *Personal Watercraft Industry Association v. Department of Commerce*, 48 F.3d 540 (D. C. Cir. 1995), the court ruled that an agency

1. Personal watercraft, as defined in 36 CFR 1.4(a) (2000), refers to a vessel, usually less than 16 feet in length, which uses an inboard, internal combustion engine powering a water jet pump as its primary source of propulsion. The vessel is intended to be operated by a person or persons sitting, standing, or kneeling on the vessel, rather than within the confines of the hull. The length is measured from end to end over the deck excluding sheer, meaning a straight line measurement of the overall length from the foremost part of the vessel to the aft most part of the vessel, measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, and similar fittings or attachments, are not included in the measurement. Length is stated in feet and inches.

can discriminate and manage one type of vessel (specifically personal watercraft) differently than other vessels if the agency explains its reasons for the differentiation.

In February 1997, the Tahoe Regional Planning Agency (TRPA), the governing body charged with ensuring no derogation of Lake Tahoe's water quality, voted unanimously to ban all two-stroke, internal combustion engines including personal watercraft because of their effects on water quality. Lake Tahoe's ban began in 2000.

In July 1998, the Washington State Supreme Court in *Weden V. San Juan County* (135 Wash. 2d 678 [1998]) found that the county had the authority to ban the use of personal watercraft as a proper use of its police power in order to protect the public health, safety, or general welfare. Further, personal watercraft are different from other vessels, and Washington counties have the authority to treat them differently.

In recognition of its duties under the *Organic Act* and NPS *Management Policies,* as well as increased awareness and public controversy, the National Park Service reevaluated its methods of PWC regulation. Historically, the National Park Service grouped personal watercraft with all vessels; thus, people could use personal watercraft when the unit's superintendent's compendium allowed the use of other vessels. Later the Park Service closed seven units to PWC use through the implementation of horsepower restrictions, general management plan revisions, and park specific regulations such as those promulgated by Everglades National Park.

In May 1998, the Bluewater Network, a coalition of more than 70 organizations representing more than 4 million Americans, filed a petition urging the National Park Service to initiate a rulemaking process to prohibit PWC use throughout the national park system. In response to the petition, the National Park Service issued an interim management policy requiring superintendents of parks where personal watercraft can occur but where it had never occurred to close the unit to such use until the rule was finalized. In addition, the National Park Service proposed a specific PWC regulation premised on the notion that personal watercraft differ from conventional watercraft in terms of design, use, safety record, controversy, visitor impacts, resource impacts, horsepower to vessel length ratio, and thrust capacity (63 FR 49, 312–17, Sept. 15, 1998).

The National Park Service envisioned the servicewide regulation as an opportunity to evaluate impacts from PWC use before authorizing the use. The preamble to the servicewide regulation calls the regulation a "conservative approach to managing PWC use" considering the resources concerns, visitor conflicts, visitor enjoyment, and visitor safety. During a 60-day comment period the National Park Service received nearly 20,000 comments.

As a result of public comments and further review, the National Park Service promulgated an amended regulation that prohibited PWC use in most units and required the remaining units to determine the appropriateness of continued PWC use (current draft of 36 CFR 3.24(a), 2000); 65 FR 15,077–90, Mar. 21, 2000). Specifically, the regulation allowed the National Park Service to designate PWC use areas and to continue their use by promulgating a special regulation in 11 units by amending the units' superintendents' compendiums in 10 units, including Lake Roosevelt National Recreation Area (current draft of 36 CFR 3.24(b), 2000). The National Park Service based the distinction between designation methods on the units' degree of motorized watercraft use.

In response to the PWC final regulation, Bluewater Network sued the National Park Service under the *Administrative Procedures Act* and the NPS *Organic Act*. The organization challenged the NPS decision to allow continued PWC use in 21 units while prohibiting such use in other units. In addition, the organization also disputed the NPS decision to allow 10 units to continue PWC use after 2002 by making entries in superintendents' compendiums, which would not require the opportunity for public input

through a notice and comments rulemaking process. Further, the environmental group claimed that because personal watercraft cause water and air pollution, generate increased noise levels, and pose public safety threats, the National Park Service acted arbitrarily and capriciously when making the challenged decisions.

In response to the suit, the National Park Service and the environmental group negotiated a settlement. The resulting settlement agreement, signed by the judge on April 12, 2001, changed portions of the NPS PWC rule. While 21 units could continue PWC use in the short-term, each of those parks desiring to continue long-term PWC use must promulgate a park-specific special regulation in 2002. In addition, the settlement stipulates that the National Park Service must base its decision to issue a park-specific special regulation to continue PWC use through an environmental analysis conducted in accordance with the *National Environmental Policy Act* (NEPA). The NEPA analysis at a minimum, according to the settlement, must evaluate PWC impacts on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety.

In 2001, the National Park Service adopted its new management policy for personal watercraft. The policy prohibits PWC use in national park system units unless their use remains appropriate for the specific park unit (NPS *Management Policies 2001* [NPS 2002c], sec. 8.2.3.3). The policy statement authorizes the use based on the park's authorizing legislation, resources, values, other park uses, and overall management strategies.

As the settlement deadline approached and the park units were preparing to prohibit PWC use, the National Park Service, Congress, and PWC user groups sought legal methods to keep the parks open to this activity. On March 28, 2002, the Personal Watercraft Industry Association (PWIA) filed suit against the National Park Service for its final PWC regulation, challenging its discrimination between personal watercraft and other vessels and the NPS decision to close units without conducting an environmental analysis. PWIA requested the court enjoin the National Park Service from implementing the ban on PWC use effective April 22, 2002. However, no method was successful. On April 22, 2002, the following units closed for PWC use: Assateague Island National Seashore; Big Thicket National Preserve; Pictured Rocks National Lakeshore; Fire Island National Seashore; and Gateway National Recreation Area. On September 15, 2002, eight other park units were scheduled to close to PWC use including Lake Roosevelt National Recreation Area. Park units, such as Lake Roosevelt, that prepare an environmental assessment to analyze PWC use alternatives and then select an alternative to continue such use will have to draft a special regulation to authorize that use in the future.

The proposed September 16, 2002 prohibition of personal watercraft was averted with the execution of a stipulated modification to the settlement agreement. The modified settlement agreement was approved by the court on September 9, 2002, and extended unrestricted PWC use in some selected national park system units until November 6, 2002.

PWC use at Lake Roosevelt National Recreation Area was stopped on November 6, 2002, and is to remain closed until the environmental assessment process has been completed. If an alternative is selected to continue PWC use, then a special regulation to authorize that use in the future will have to be drafted.

PURPOSE OF AND NEED FOR ACTION

The purpose of and the need for taking action is to evaluate a range of alternatives and strategies for the management of PWC use at Lake Roosevelt National Recreation Area in order to ensure the protection of park resources and values while offering recreational opportunities as provided for in the national recreation area's authorizing legislation, purpose, mission, and goals. Upon completion of the NEPA

process, the National Park Service may either take action to adopt special regulations to manage PWC use at Lake Roosevelt, or remain closed to PWC use as allowed for in the National Park Service March 2000 rule.

This environmental assessment evaluates three alternatives concerning the use of personal watercraft at Lake Roosevelt. The alternatives include:

- *Alternative A*: Reinstate PWC use under a special NPS regulation as previously managed in accordance with NPS *Management Policies 2001*, park practices, and state regulations.

- *Alternative B*: Reinstate PWC use under a special NPS regulation with additional management prescriptions, such as implementation of additional flat-wake zones and resource monitoring. Alternative B has been identified as the preferred alternative.

- *No-Action Alternative*: Continue the prohibition of PWC use on NPS-managed waters of Lake Roosevelt.

SCOPE OF THE ANALYSIS

Motorboats and other watercraft have been used in Lake Roosevelt National Recreation Area since its establishment in 1946, and boating is a primary use of the lake. PWC use began in the 1980s. While some effects of PWC use are similar to other watercraft and therefore difficult to distinguish, the focus of this action is in support of decisions and rulemaking specific to PWC use. However, while the settlement agreement and need for action have defined the scope of this environmental assessment, NEPA requires an analysis of cumulative effects on resources of all past, present, and reasonably foreseeable actions when added to the effects of the proposal (40 CFR 1508.7, 2000). The scope of this analysis, therefore, is to define management alternatives specific to PWC use, in consideration of other uses, actions, and activities cumulatively affecting park resources and values.

Because of the split jurisdiction on Lake Roosevelt where control of the water surface is divided between the National Park Service and two tribal entities, it is incumbent upon the National Park Service to develop PWC management alternatives and rules that are consistent with the managing partners to the degree possible in order to facilitate understanding and compliance by the boating public and enforcement by the managing entities. Neither the Spokane Tribe of Indians nor the Confederated Tribes of the Colville Reservation has indicated that they intend to adopt rules pertaining to personal watercraft at this time. Unilateral adoption of rules by the National Park Service that differ from rules applicable to other portions of the lake without good cause would be counter to the objective of “seamless” management of the water surface and would likely not be supported by the tribal governments, local governments or large segments of the general public.

PURPOSE AND SIGNIFICANCE OF LAKE ROOSEVELT NATIONAL RECREATION AREA

Congress establishes national park system units to fulfill specified purposes, based on a park’s unique and significant resources. A park’s purpose, as established by Congress, is the fundamental building block for its decisions to conserve resources while providing for “enjoyment of future generations.”

LEGISLATIVE INTENT OF LAKE ROOSEVELT NATIONAL RECREATION AREA

Lake Roosevelt National Recreation Area was established in 1946 following the Secretary of the Interior's approval of a Tri-Party Agreement among the National Park Service, the Bureau of Reclamation, and the Bureau of Indian Affairs. The reservoir and related lands were administered as the recreation area under this agreement until 1974 when Interior Secretary Rogers C.B. Morton directed that the agreement for the management of the lake be expanded to include the Confederated Tribes of the Colville Reservation and the Spokane Tribe of Indians. Secretary Morton's directive was prompted by the Interior Solicitor's opinion that the tribes have exclusive rights to hunting, boating, and fishing within those areas of the reservoir that are within the boundaries of the two Indian reservations. An accord was reached on April 5, 1990 when the Secretary of the Interior approved the Lake Roosevelt Cooperative Management Agreement. The agreement confirmed and established management authority of the two Indian tribes over the portions of Lake Roosevelt and related lands within the boundaries of their respective reservations that were previously administered as part of the national recreation area.

With the approval of the Lake Roosevelt Cooperative Management Agreement, Lake Roosevelt National Recreation Area was defined as the waters and lands managed by the National Park Service. Lake Roosevelt National Recreation Area consists of 312 miles of shoreline, 47,438 acres of the 81,389-acre water surface (at full pool), and 12,936 acres of land. The lands of Lake Roosevelt National Recreation Area consist primarily of a narrow band of shore above the maximum high water mark (1,290 feet), which was originally purchased by the Bureau of Reclamation for construction of the reservoir. The national recreation area also includes shoreline along about 29 miles of the Spokane River Arm of the lake and about 7 miles along the Kettle River Arm. Most of the remainder of the shoreline and surface area of Lake Roosevelt lies within the reservation boundaries of the Spokane Tribe and the Colville Confederated Tribes and is not part of the national recreation area. The Bureau of Reclamation retains the management of the dam, an area immediately around the dam, and a few other locations that are necessary for operating the reservoir.

PURPOSE OF LAKE ROOSEVELT NATIONAL RECREATION AREA

The purpose and significance statements below are from Lake Roosevelt's *Strategic Plan* (NPS 2000e) and *General Management Plan* (NPS 2000c). Lake Roosevelt National Recreation Area was established for the following purposes:

- To provide opportunities for diverse, safe, quality, outdoor recreational experiences for the public.
- To preserve, conserve, and protect the integrity of natural, cultural, and scenic resources.
- To provide opportunities to enhance public appreciation and understanding about the area's significant resources.

SIGNIFICANCE OF LAKE ROOSEVELT NATIONAL RECREATION AREA

The following statements summarize the significance of Lake Roosevelt:

- It offers a wide variety of recreation opportunities in a diverse natural setting on a 154-mile-long lake that is bordered by 312 miles of publicly owned shoreline that is available for public use.

- It contains a large section of the upper Columbia River and a record of continuous human occupation dating back more than 9,000 years.

- It is contained within three distinct geologic provinces – the Okanogan Highlands, the Columbia Plateau, and the Kootenay Arc, which were sculpted by Ice Age floods.

The park's mission statement is as follows: As a unit of the national park system, Lake Roosevelt National Recreation Area is dedicated to conserving, unimpaired, the natural and cultural resources and recreational and scenic values of Lake Roosevelt for the enjoyment, education, and inspiration of this and future generations. The recreation area also shares responsibility for advancing a great variety of programs designed to help extend the benefits of natural and cultural resource conservation and outdoor recreation.

BACKGROUND

NPS ORGANIC ACT AND MANAGEMENT POLICIES

By enacting the NPS *Organic Act of 1916* (*Organic Act*), Congress directed the National Park Service to manage units under its jurisdiction "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1). Congress reiterated this mandate in the Redwood National Park *Expansion Act of 1978* by stating that the National Park Service must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1 a-1).

Despite these mandates, the *Organic Act* and its amendments afford the National Park Service latitude when making resource decisions that balance visitor recreation and resource preservation. By these acts Congress "empowered the National Park Service with the authority to determine what uses of park resources are proper and what proportion of the parks resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt,* 82 F.3d 1445, 1453 (9th Cir. 1996)).

Yet, courts consistently interpreted the *Organic Act* and its amendments to elevate resource conservation above visitor recreation. *Michigan United Conservation Clubs v. Lujan,* 949 F.2d 202, 206 (6th Cir. 1991) states, "Congress placed specific emphasis on conservation." The *National Rifle Ass'n of America v. Potter,* 628 F. Supp. 903, 909 (D.D.C. 1986) states, "In the *Organic Act* Congress speaks of but a single purpose, namely, conservation." The NPS *Management Policies* also recognize that resource conservation takes precedence over visitor recreation. The policy dictates "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant" (NPS *Management Policies 2001* [NPS 2000f] sec. 1.4.3).

Because conservation remains predominant, the National Park Service seeks to avoid or to minimize adverse impacts on park resources and values. Yet, the Park Service has discretion to allow negative impacts when necessary (NPS *Management Policies 2001,* [NPS 2000f] sec. 1.4.3). While some actions and activities cause impacts, the National Park Service cannot allow an adverse impact that constitutes a resource impairment (NPS *Management Policies 2001,* [NPS 2000f] sec. 1.4.3). The *Organic Act* prohibits actions that permanently impair park resources unless a law directly and specifically allows for the acts (16 USC 1 a-1). An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS *Management Policies 2001,* [NPS 2000f] sec. 1.4.4). To determine

impairment, the National Park Service must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (NPS *Management Policies 2001,* [NPS 2000f] sec. 1.4.4).

Because park units vary based on their authorizing legislation, natural resources, cultural resources, and missions, the recreational activities appropriate for each unit and for areas within each unit vary as well. An action appropriate in one unit could impair resources in another unit. Thus, this environmental assessment analyzes the context, duration, and intensity of impacts related to PWC use at Lake Roosevelt National Recreation Area, as well as potential for resource impairment, as required by *Director's Order #12: Conservation Planning, Environmental Impact Analysis and Decision-making* (NPS 2001b*).*

SUMMARY OF NATIONAL RESEARCH ON THE EFFECTS OF PERSONAL WATERCRAFT

Over the past two decades PWC use in the United States increased dramatically. However, there are conflicting data about whether PWC use is continuing to increase. While the National Transportation Safety Board (NTSB) estimates that retailers sell approximately 200,000 personal watercraft each year and people currently use another 1 million (NTSB 1998); the PWC industry argues that PWC sales have decreased by 50% from 1995 to 2000 (American Watercraft Association [AWA] 2001). National PWC ownership increased every year between 1991 and 1998; the rate of annual increase peaked in 1994 at 32% and dropped slightly in 1999, 2000, and 2001 (see table 1).

The majority of personal watercraft used today are powered by conventional two-stroke engines (NPS 1998, CARB 1999). Multiple studies have demonstrated that four-stroke engines are substantially cleaner than carbureted, two-stroke engines, generating approximately 90% fewer emissions (Warrington 1999; OQED 1999; Tahoe Regional Planning Agency 1999). PWIA notes that direct-injection engines have been available in personal watercraft for four years; and three PWC manufacturers introduced four-stroke engines for the 2002 model year (PWIA 2002b). The U.S. Environmental Protection Agency (EPA) assumes that the existing two-stroke engine models would not be completely replaced by newer PWC technology until 2050 (40 CFR 89, 90, 91).

TABLE 1: NATIONAL PWC REGISTRATION TREND

Year	Number of Boats Owned	Number of Personal Watercraft Owned	Boat Ownership Trend (Percentage Change)	PWC Ownership Trend (Percentage Change)
1991	16,262,000	305,915	—	—
1992	16,262,000	372,283	0%	21.7%
1993	16,212,000	454,545	0%	22.1%
1994	16,239,000	600,000	0%	32.0%
1995	15,375,000	760,000	-5%	26.7%
1996	15,830,000	900,000	3%	18.4%
1997	16,230,000	1,000,000	3%	11.1%
1998	16,657,000	1,100,000	3%	10.0%
1999	16,773,000	1,096,000	1%	-0.4%
2000	16,965,000	1,078,400	1%	-1.6%
2001		1,053569		-2.4%

Source of boat information: USCG 2001.

Source of PWC information: National Marine Manufacturers Association (NMMA) 2002.

The average operating life of a personal watercraft is 5 to 10 years, depending upon the source. The formula for determining the operating life of personal watercraft was published in the *Federal Register* on October 4, 1996 (EPA 1996a). Based on this formula, the National Park Service expects that by 2012, most boat owners will already be in compliance with the 2006 EPA marine engine standards. The Personal Watercraft Industry Association believes the typical operating life of a PWC rental is 3 years and approximately 5 to 7 years for a privately owned vessel (PWIA 2002b).

Environmental groups, PWC users and manufacturers, and land managers express differing opinions about the environmental consequences of PWC use, and about the need to manage or to limit this recreational activity. Research conducted on the effects of PWC use is summarized below for water pollution, air pollution, noise, wildlife, shoreline vegetation and erosion effects, and health and safety concerns.

Water Pollution

The vast majority of personal watercraft in use today are two-stroke, non-direct-injection engines, which discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). Hydrocarbons, benzene, toluene, and xylene are also released, as well as methyl tertiary-butyl ether (MTBE) in states that use this additive. In 1996, the Environmental Protection Agency promulgated a rule to control exhaust emissions from new marine engines, including outboards and personal watercraft. Emission controls provide for increasingly stricter standards beginning in model year 1996 (EPA 1997).

In 1996, the Environmental Protection Agency estimated an overall 52% reduction in hydrocarbon emissions from marine engines from present levels by 2010, and a 75% reduction by 2030, based on conversion of polluting machines. The 1997 EPA rule delayed implementation by one year (EPA 1996a, 1997). However, changing from two-stroke carbureted engines to two-stroke direct-injection engines may result in increases of airborne particulate-associated PAH (Kado et al. 2000). Polycyclic aromatic hydrocarbons (PAH), including benzo(a)pyrene, naphthalene, and 1-methyl naphthalene, are released during the combustion of fuel, though some PAH are also found in unburned gasoline. Further research is needed to identify what impact this would have on PAH concentration in water.

PAH, as well as other hydrocarbon emissions into the water, could potentially be reduced as new four-stroke engines replace older carbureted two-stroke engines. The conversion of carbureted two-stroke engines would be an important step toward substantially reducing petroleum related pollutants.

A recent study conducted by the California Air Resources Board consisted of a laboratory test designed to comparatively evaluate exhaust emissions from marine and PWC engines, in particular two- and four-stroke engines (CARB 2001). The results of this study showed a difference in emission (in some cases 10 times higher total hydrocarbons in two-stroke engines) between these two types of engines. An exception was air emissions of nitrogen oxides (NO_x) which was higher in four-stroke than in two-stroke engines. Concentrations of pollutants (MTBE; benzene, toluene, ethyl benzene, and xylene [BTEX]) in the tested water were consistently higher for two-stroke engines.

The amount of pollution correctly attributed to personal watercraft compared to other motorboats and the degree to which personal watercraft affect water quality remains debatable. As noted in a report by the Oregon Department of Environmental Quality, every water body has different conditions (e.g., water temperature, air temperature, water mixing, motorboating use, and winds) that affect the pollutants' impacts (ODEQ 1999).

Discharges of MTBE and PAH particularly concern scientists because of their potential to adversely affect the health of people and aquatic organisms. Scientists need to conduct additional studies on PAH (Allen et al. 1998) and on MTBE (NPS 1999), as well as long-term studies on the effect of repeated exposure to low levels of these pollutants (Asplund 2001).

At Lake Tahoe concern about the negative impact on lake water quality and aquatic life caused by the use of two-stroke marine engines led to at least 10 different studies relevant to motorized watercraft in the Tahoe Basin in 1997 and 1998. The results of these studies (Allen et al. 1998) confirm that (1) petroleum products are in the lakes as a result of motorized watercraft operation, and (2) watercraft powered by carbureted two-stroke engines discharge pollutants at an order of magnitude greater than do watercraft powered by newer technology engines (Tahoe Regional Planning Agency 1999).

On June 25, 1997, the Tahoe Regional Planning Agency adopted an ordinance prohibiting the "discharge of unburned fuel and oil from the operation of watercraft propelled by carbureted two-stroke engines" beginning June 1, 1999. Following the release of an environmental assessment in January 1999, this prohibition was made permanent.

Air Pollution

Personal watercraft emit various compounds that pollute the air. In the two-stroke engines commonly used in personal watercraft, the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as hydrocarbons (HC), NO_x, particulate matter (PM), and carbon monoxide (CO). In areas with high PWC use, some air quality degradation likely occurs (EPA 1996a, 2000c). Kado et al. (2000) found that two-stroke engines had considerably higher emissions of airborne particulates and PAH than four-stroke engines tested. It is assumed that the 1996 EPA rule concerning marine engines will substantially reduce air emissions from personal watercraft in the future (EPA 1996a).

In August 2002, the Environmental Protection Agency proposed additional rules that would further reduce boating emissions. The proposal includes evaporative emission standards for all gasoline-fueled boats and personal watercraft manufactured after 2008 and would reduce emissions from fuel tanks by 80% (67 FR 157, August 14, 2002, pp. 53049–53115).

Noise

PWC-generated noise varies from vessel to vessel. No literature was found that definitively described scientific measurements of PWC noise. Some literature stated that all recently manufactured watercraft emit fewer than 80 decibels (dB) at 50 feet from the vessel, while other sources attributed levels as high as 102 decibels without specifying the distance. None of this literature fully described the method used to collect noise data.

The National Park Service contracted for noise measurements of personal watercraft and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris Miller Miller & Hanson, Inc. 2002). The results show that maximum PWC noise levels at 25 meters (82 feet) ranged between 68 to 76 decibels on the A-weighted scale (dBA). Noise levels for other motorboat types of similar horsepower to the personal watercraft measured during that study ranged from 65 to 77 dBA at 25 meters (82 feet). The larger boats, characterized as "V8 'muscle' boats", had noise levels of 85 to 86 dBA at 25 meters (82 feet).

Noise limits established by the National Park Service require vessels to operate at less than 82 dB at 82 feet from the vessel. Personal watercraft may be more disturbing than other motorized vessels because of rapid changes in acceleration and direction of noise. However, this regulation does not imply that there are no noise impacts from vessels operating below that limit. Noise impacts from PWC use are caused by a number of factors. Noise from human sources, including personal watercraft, can intrude on natural soundscapes, masking the natural sounds, which are an intrinsic part of the environment. This can be especially true in quiet places, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are non-motorized watercraft users (such as canoeists, sailing enthusiasts, people fishing or picnicking, and kayakers) can disrupt the "passive" experience of park resources and values.

Komanoff and Shaw (2000) note that the biggest difference between noise from personal watercraft and that from motorboats is that the former continually leave the water, which magnifies noise in two ways. Without the muffling effect of water, the engine noise is typically 15 dBA louder and the smacking of the craft against the water surface results in a loud "whoop" or series of them. With the rapid maneuvering and frequent speed changes, the impeller has no constant "throughput" and no consistent load on the engine. Consequently, the engine speed rises and falls, resulting in a variable pitch. This constantly changing sound is often perceived as more disturbing than the constant sound from motorboats.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists (e.g., if identical boats emit 75 dB, two such boats together would be expected to emit 78 dB, 3 together would emit 80 dB). Motorboats traveling back and forth in one area at open throttle or spinning around in small inlets also generate complaints about noise levels; however, most motorboats tend to operate away from shore and to navigate in a straight line, thus being less noticeable to other recreationists (Vlasich 1998).

Research conducted by the Izaak Walton League (IWL) indicates that one PWC unit can emit between 85 and 105 dB of sound, and that wildlife or humans located 100 feet away may hear sounds of 75 dB. This study also stated that rapid changes in acceleration and direction may create a greater disturbance and emit sounds of up to 90 dB (IWL 1999). Other studies conducted by the New Jersey State Police indicate that at a distance of 50 feet, a PWC unit with a 100-horsepower (hp) engine emits up to 76 dBA, while a single, 175-hp outboard engine emits up to 81 dBA. Sea-Doo research indicates that in three out of five distances measured during a sound level test, PWC engines were quieter than an outboard motorboat. Sea-Doo also found that it would take approximately four PWC units, 50 feet from the shore to produce 77 dBA, and it would take 16 PWC vessels operating at 15 feet from the shore to emit 83 dBA of sound, which is equal to one open exhaust boat at 1,600 feet from the shore. Additionally, by 2006 the EPA requirements will reduce PWC noise, in association with improvements to engine technology (EPA 1996b). EPA research also indicated that one PWC unit operating 50 feet from an onshore observer emits a sound level of 71 dBA, and studies conducted using the Society of Automotive Engineers (2001) found that two PWC units operating 50 feet from the shore emit similar sound levels of about 74 dBA (PWIA 2000b).

Most studies on the effects of noise on soundscapes and human receptors have focused on highway and airport noise. Komanoff and Shaw (2000) used the analytical approaches of these studies to perform a noise-cost analysis of personal watercraft. They concluded that the cost to beachgoers from PWC noise was more than $900 million per year. The cost per personal watercraft was estimated to be about $700 per vessel each year or $47 for each 3-hour "personal watercraft day." They concluded that the cost per beachgoer was the highest at secluded lake sites, where beachgoers had a higher expectation of experiencing natural quiet and usually invested a larger amount of time and personal energy in reaching the area. However, because there are many more visitors to be affected at popular beaches, noise costs per

personal watercraft were highest at crowded sites (*Drowning in Noise: Noise Costs of Jet Skis in America* [Komanoff and Shaw 2000]).

Wildlife Impacts

Few studies have specifically examined PWC effects on wildlife. Based on observations, some wildlife disturbances and harassment likely occurs, probably caused by speed, noise, and access. Nesting colonial birds are particularly susceptible to disturbance; however, the extent, duration, and magnitude of biological impacts because of PWC operations versus other motorboats remain unknown. Burger (2000) examined the behavior of common terns in relation to PWC use and other boats and noted that PWC users traveled faster and came closer to banks, resulting in more flight response in terns and contributing to lower reproductive success.

Shoreline Vegetation

The effects of personal watercraft on aquatic communities have not been fully studied, and scientists disagree about whether personal watercraft adversely impact aquatic vegetation. The majority of concern arises from the shallow draft of personal watercraft, allowing access to shallow areas that conventional motorboats cannot reach. Like other vessels, personal watercraft may destroy grasses that occur in shallow water ecosystems. Anderson (2000) studied the effect of PWC wave-wash on shallow salt marsh vegetation and found that although the waves from personal watercraft are not different from those generated by other boats, personal watercraft can enter marsh channels and create sediment suspension problems in these areas.

Erosion Effects

Some studies have examined the erosion effects of PWC waves and other studies suggest that personal watercraft may disturb sediments on river or lake bottoms and cause turbidity. Conflicting research exists concerning whether PWC-caused waves result in erosion and sedimentation, but some research suggests that PWC-induced wakes are larger at slower speeds than other boats, and when operated close to shore the wakes can cause erosion and ultimately shoal formation (Vlasich 1998). PWC-generated wave sizes vary depending on the environment, including weight of the driver, number of passengers, and speed. Anderson (2000) studied the effect of PWC wave-wash on shallow salt marsh vegetation and found that although the waves from personal watercraft are not different from those generated by other boats, personal watercraft can enter marsh channels and create sediment suspension problems in these areas.

Health and Safety Concerns

Industry representatives report that PWC accidents decreased in some states in the late 1990s. The National Transportation Safety Board (NTSB) reported that in 1996 personal watercraft represented 7.5% of state-registered recreational boats but accounted for 36% of recreational boating accidents. In the same year PWC operators accounted for more than 41% of people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998).

Increased PWC use in recent years has resulted in more concern about the health and safety of operators, swimmers, snorkelers, divers, and other boaters. A 1998 National Transportation Safety Board study revealed that while recreational boating fatalities have been declining in recent years, PWC-related

fatalities have increased (NTSB 1998). Nationwide PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities (see table 2) however, since a peak of 84 PWC-related fatalities in 1997, accidents, injuries, and fatalities involving personal watercraft have decreased (US Coast Guard 2001). The U.S. Coast Guard's Office of Boating Safety studied exposure data to assess boating risks. This method allows for a comparison between boat types based on comparable time in the water. Personal watercraft use ranked second in boat type for fatalities per million hours of exposure in 1998, with a 0.24 death rate per million exposure hours.

Due to their ability to reach speeds in the 60 mph range and their ability to access shallow-draft areas, personal watercraft can create wakes that pose a conflict for both shore and boat fishermen and a safety hazard to other users such as canoeists, kayakers and windsurfers. In addition, since PWC operators can be as young as 12 in several states, accidents can involve children. The American Academy of Pediatrics (2000) recommends that no one younger than 16 operate personal watercraft. Some manufacturing changes on throttle and steering may reduce potential accidents. For example, on more recent models, Sea-Doo developed an off-power assisted steering system that helps steer during off-power as well as off-throttle situations. This system, according to company literature, is designed to provide additional maneuverability and improve the rate of deceleration (Sea-Doo 2001a).

PWC USE AND REGULATION AT LAKE ROOSEVELT NATIONAL RECREATION AREA

A variety of watercraft can be found on Lake Roosevelt during the summer season, e.g., ski boats, personal watercraft, runabouts, day cruisers, sailboats (some with auxiliary motors), houseboats, and, to a lesser degree, canoes, kayaks and rowboats. Activities on the lake associated with boating include sightseeing, water skiing, fishing, swimming, camping, picnicking, and sailing. There were over 50,000 boat launches during the 2001 primary boating season. Most boaters reside within 100 miles of Lake Roosevelt but others come from cities and communities throughout Washington, as well as from Idaho and Canada.

TABLE 2: NATIONWIDE PWC ESTIMATES AND ACCIDENT STATISTICS

Year	Recreational Boats Owned*	PWC Owned*	Number of PWC in Accidents	Number of PWC Injuries	Number of PWC Fatalities	Number of All Boats Involved in Accidents	Percentage of PWC Involved in Accidents
1987	14,515,000	N/A	376	156	5	9,020	4.2
1988	15,093,000	N/A	650	254	20	8,981	7.2
1989	15,658,000	N/A	844	402	20	8,020	10.5
1990	15,987,000	N/A	1,162	532	28	8,591	13.5
1991	16,262,000	305,915	1,513	708	26	8,821	17.2
1992	16,262,000	372,283	1,650	730	34	8,206	20.1
1993	16,212,000	454,545	2,236	915	35	8,689	25.7
1994	16,239,000	600,000	3,002	1,338	56	9,722	30.9
1995	15,375,000	760,000	3,986	1,617	68	11,534	34.6
1996	15,830,000	900,000	4,099	1,837	57	11,306	36.3
1997	16,230,000	1,000,000	4,070	1,812	84	11,399	35.7
1998	16,657,000	1,100,000	3,607	1,743	78	11,368	31.7
1999	16,773,000	1,096,000	3,374	1,614	66	11,190	30.2
2000	16,965,000	1,078,400	3,282	1,580	68	11,079	29.6
Total			**33,851**	**15,238**	**645**		

Source: M. Schmidt, USCG, e-mail comm., Sept. 4, 2001.

*Estimates provided by the National Marine Manufacturers Association (USCG 2001).

Lake Roosevelt National Recreation Area maintains 22 boat launch facilities, including 13 with campgrounds. Watercraft are piloted over the main surface of the lake, along the lakeshore, and in coves and back bays. Many boaters camp in one of the ten boat-accessible campgrounds or along the miles of undeveloped shoreline that are available for camping.

PWC use began on Lake Roosevelt during the 1980s but did not become fairly common until the mid-1990s. Personal watercraft are often used as a houseboat accessory. Activities undertaken by personal watercraft on Lake Roosevelt include running up and down sections of the lake, towing skiers, jumping wakes, and general boating activities. Surveys of boat trailers conducted in 2001 and 2002 estimate the number of personal watercraft to be approximately 4% of all boating use at Lake Roosevelt. Personal watercraft are allowed to launch, operate, and beach from dawn to dusk throughout the national recreation area. The primary PWC use season is June through September with some use from April through May and October through December, but no use in winter months because the weather and water is generally too cold.

Personal watercraft are regulated as vessels under the Superintendent's Compendium and, prior to the court-ordered ban, were allowed in all areas of the lake. Areas 100 feet around swim beaches, marinas, and narrow sections of the lake have speed restrictions applicable to all boats based on state boating regulations. Flat-wake areas on the lake include Hawk Creek from the waterfall at the campground to an area called "the narrows" and on the Kettle River above the Napoleon Bridge. Crescent Bay Lake is closed to all motorized craft.

None of the concessioners at Lake Roosevelt currently rent personal watercraft. Within 60 to 100 miles of the park, a total of five PWC dealerships were identified in Wenatchee, Spokane, and Okanogan were found. No PWC dealerships were identified closer to the park. A total of three rental shops were found within 30 miles of the park including Banks Lake, Sun Lake, and Blue Lake.

Within 100 miles of Lake Roosevelt National Recreation Area there are several major lakes and many smaller lakes that allow personal watercraft. The larger lakes include Banks Lake and Lake Chelan in Washington and Lake Coeur d'Alene and Lake Pend Oreille in Idaho.

OBJECTIVES IN TAKING ACTION

Objectives define what must be achieved for an action to be considered a success. Alternatives selected for detailed analysis must meet all objectives and must also resolve purpose of and need for action.

Using the park's authorizing legislation, mandates and direction in the *2000 General Management Plan* (NPS 1999) and *Fiscal Year 2001 – 2005 Strategic Plan* (NPS 2000e), issues, and servicewide objectives, park staff identified the following management objectives relative to PWC use:

WATER QUALITY

- Manage PWC emissions that enter the water in accordance with NPS anti-degradation policies and goals.

- Protect plankton and other aquatic organisms from PWC emissions and sediment disturbances so that the viability of dependent species is conserved.

- Manage PWC emissions so that potable water supplies are not impacted.

AIR QUALITY

- Manage PWC activity so that PWC air emissions of harmful compounds do not appreciably degrade ambient air quality to levels that affect human health and air quality values such as visibility and vegetative health.

SOUNDSCAPES

- Manage noise from PWC use in affected areas so that visitors' health, safety, and visitor experiences are not adversely affected.

WILDLIFE AND WILDLIFE HABITAT

- Protect fish and wildlife species (including threatened or endangered species) and their habitats from unnecessary disturbances by personal watercraft.

- Protect birds and waterfowl from the effects of PWC-generated noise, especially during nesting seasons.

THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

- Protect threatened and endangered species, and species of special concern, and their habitats from PWC disturbances.

SHORELINE VEGETATION

- Manage PWC use to protect sensitive shoreline areas (vegetation/erosion) from PWC activity and access.

VISITOR USE AND EXPERIENCE

- Manage the potential conflicts between PWC use and park visitors in order to minimize adverse effects to visitor experience.

VISITOR CONFLICT AND VISITOR SAFETY

- Minimize or reduce the potential for PWC user accidents.

- Minimize or reduce the potential safety conflicts between PWC users and other water recreationists.

CULTURAL RESOURCES

- Manage PWC use and access to protect cultural resources including sacred sites important to Native Americans.

SOCIOECONOMICS

- Work cooperatively with concessioners and local businesses that rent or sell personal watercraft.

ENVIRONMENTAL JUSTICE

- Minimize potential impacts on minority and low-income populations.

NATIONAL RECREATION AREA MANAGEMENT AND OPERATIONS

- Minimize impacts to recreation area operations from increased enforcement needs.
- Seek cooperation with local and state entities that manage or regulate PWC use.

ISSUES AND IMPACT TOPICS

Issues associated with PWC use at Lake Roosevelt National Recreation Area were identified during the scoping process with NPS staff at the park. Many of these issues were identified in the settlement agreement with the Bluewater Network, which requires that, at a minimum, the effects of PWC use be analyzed for the following: water quality, air quality, soundscapes, wildlife and wildlife habitat, shoreline vegetation, visitor conflicts and visitor safety. Potential impacts to other resources were considered as well. The following impact topics are discussed in the "Affected Environment" chapter and analyzed in the "Environmental Consequences" chapter. If no impacts are expected, based on available information, then the issue was eliminated from further discussion, as explained in the "Issues Eliminated from Further Consideration" section.

WATER QUALITY

As mentioned in the summary of national research section, the vast majority of personal watercraft in use today are two-stroke, carbureted engines, which discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). The primary PWC related water quality issue at Lake Roosevelt National Recreation Area is related to the potential effects from these types of emissions.

Research has also revealed concerns regarding the effects of PWC emissions on ecologically sensitive plankton and other small water organisms in shallow water ecosystems through phototoxicity (EPA 1998; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). Within the national recreation area, productive shallow water ecosystems are primarily associated with tributaries and are not found along the main body of the reservoir. Other potential water quality issues related to PWC use at Lake Roosevelt include impacts on drinking water sources. Two communities, Grand Coulee and Coulee Dam, use surface water from Lake Roosevelt for drinking water.

AIR QUALITY

Pollutant emissions such as nitrogen oxides and hydrocarbons from PWC use may adversely affect air quality. These compounds react with sunlight to form ozone. Although air quality within the park is very good, there is a potential for personal watercraft to cause some localized impacts, particularly if PWC use were to increase significantly.

SOUNDSCAPES

Noise limits established by the National Park Service require vessels to operate at less than 82 dB at 82 feet. Personal watercraft may be more disturbing than other motorized vessels because of rapid changes in acceleration and direction of noise.

Lake Roosevelt National Recreation Area receives occasional complaints of PWC noise from local residents on the Spokane arm of the reservoir near Porcupine Bay, which is susceptible to noise because of its narrow topography. Occasionally, campers and picnickers also complain of noise from personal watercraft, especially at dusk.

WILDLIFE AND WILDLIFE HABITAT

Some research suggests that personal watercraft impact wildlife through interruption of normal activities, alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. Waterfowl and nesting birds are thought to be especially susceptible to PWC activity because of their noise, speed, and ability to access shallow-water areas more readily than other types of watercraft. This may force nesting birds to abandon eggs during crucial embryo development stages and flush waterfowl from habitat, causing stress and associated behavior changes. PWC collisions with waterfowl and other wildlife are another potential concern.

Lake Roosevelt is in the Pacific Flyway and serves as a resting area for many species during migration periods. Due to cold water temperatures, PWC use is extremely low during peak migratory times. Waterfowl and shorebird nesting sites are not common within the national recreation area due to the lack of suitable nesting habitat along the shoreline of Lake Roosevelt. The most suitable habitat is found in wetland and marshy areas associated with drainages such as Hawk Creek and the upper Kettle River. Because Lake Roosevelt is linear and has such a narrow public land base, terrestrial habitat for wildlife within the recreation area is limited. Nesting birds near the shoreline may be disturbed by personal watercraft, although the park has no evidence that this is common.

THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

Similar to wildlife, personal watercraft may affect federally listed or other species of concern through interruption of normal activities; alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. At Lake Roosevelt, bald eagle and peregrine falcon are special status species that could potentially be impacted by personal watercraft.

More than 200 bald eagles winter at Lake Roosevelt from November to March annually. More than 21 bald eagle nests are in the vicinity of the lake. Peregrine falcon nests have been located in the area surrounding Lake Roosevelt. The recreation area is also used by peregrine falcons during spring and fall migrations.

Because of the Grand Coulee Dam, Lake Roosevelt National Recreation Area has no significant threatened and endangered fish population. Bull trout are thought to potentially inhabit the lake, but only in very small numbers if at all.

Other special status species may occasionally occur within the recreation area, but none are thought to vulnerable to adverse effects from PWC use.

SHORELINE VEGETATION

Personal watercraft are often able to access shoreline or shallow water areas where most other watercraft cannot go, potentially leading to disturbance of vegetation resources through direct disturbance or by allowing visitors to access inland areas where sensitive vegetation may exist.

The Lake Roosevelt shoreline is largely devoid of sensitive vegetation, and below full pool elevation there is mostly sand and little vegetation. Wetland and riparian communities are associated with tributaries such as the Hawk Creek and Kettle River. There is no evidence of past PWC impacts to these areas.

Some research shows that personal watercraft create a wake at slower speeds than larger boats, and when driven close to shore their wakes can lead to erosion and ultimately shoal formation (Vlasich 1998). Erosion at Lake Roosevelt may be a concern during low water times. Shoreline vegetation communities at Lake Roosevelt are primarily located along tributaries such as Hawk Creek and the upper Kettle River.

VISITOR EXPERIENCE

Some research suggests that personal watercraft are viewed by some segments of the public as a ‘nuisance’ due to their noise, speed, and overall environmental effects while others believe personal watercraft are no different from other watercraft and have a ‘right’ to enjoy the sport. There has been some conflict between personal watercraft and fishermen, canoeists and swimmers at Lake Roosevelt.

VISITOR CONFLICTS AND SAFETY

PWC Accidents and Unsafe Behavior

Due to their ability to reach speeds in the 60 mph range and their ability to access shallow-draft areas, personal watercraft can create wakes that pose a conflict for both shore and boat fishermen and a safety hazard to other users such as canoeists, kayakers and windsurfers. At Lake Roosevelt National Recreation Area, some complaints by fisherman, canoeists or swimmers are received concerning wakes created by personal watercraft. Some complaints are also received concerning the speed of personal watercraft.

A total of eight safety incidents involving personal watercraft occurred on Lake Roosevelt during the years 1997 through 2002. There are documented complaints regarding unsafe behavior by PWC users at Lake Roosevelt National Recreation Area. Personal watercraft, due to their increased accident rates and visitor safety conflicts, may require additional park staff in some areas to enforce standards and limits.

CULTURAL RESOURCES

Some park units may have cultural resources listed, or may be potentially listed (NRHP), that may be affected along shorelines (erosion), or uncontrolled visitor access since riders are able to access, beach, or launch in areas less accessible to most motorized watercraft. At Lake Roosevelt, during the anticipated spring drawdown, archeological sites may become more accessible and may become more susceptible to erosion and/or looting or vandalism.

SOCIOECONOMICS

National PWC ownership increased every year between 1991 and 1998; the rate of annual increase peaked in 1994 at 32% and dropped slightly in 1999, 2000, and 2001. Rentals of personal watercraft have also increased exponentially compared to other types of watercraft. Some businesses may be affected by actions to either increase or decrease PWC use.

Within 60 to 100 miles of the park, five total PWC dealerships were identified in Wenatchee, Spokane, and Okanogan were found. No PWC dealerships were identified closer to the park. Three rental shops were found within 30 miles of the park including Lake Banks, Lake Sun, and Blue Lake.

ENVIRONMENTAL JUSTICE

In some cases, PWC use may affect minority or low-income populations, for example, a small business in a very small low-income community that rents personal watercraft as its only source of income. No PWC rental facilities are located at Lake Roosevelt. If PWC use is prohibited in the national recreation area, PWC use would be displaced onto tribal waters and could potentially affect the number of personal watercraft launching at tribal marinas.

NATIONAL RECREATION AREA MANAGEMENT AND OPERATIONS

Conflict with State and Local Ordinances and Policies Regarding PWC Use

Some states and local governments have taken action, or are considering taking action, to limit, ban, or otherwise manage PWC use. While the park may be exempt from these local actions, consistency with state and local plans must be evaluated. Because of the split jurisdiction on Lake Roosevelt where control of the water surface is divided between the National Park Service and two Indian Tribes, it is incumbent upon the National Park Service to develop management strategies that are consistent with the managing partners to the degree possible in order to facilitate understanding and compliance by the boating public and enforcement by the managing entities. Neither tribe has indicated that they intend to adopt rules pertaining to personal watercraft at this time. Unilateral adoption of rules by the National Park Service that differ from rules applicable to other portions of the lake without good cause would be counter to the objective of “seamless” management of the water surface and would likely not be supported by the tribal governments, local governments or large segments of the general public.

Impact to Park Operation from Increased Enforcement Needs

PWC use may require additional park staff to enforce standards, limits, or closures because of increased accident rates and visitor conflicts. Enforcement capabilities are currently limited at Lake Roosevelt and enforcement of additional regulations may pose a challenge.

ISSUES ELIMINATED FROM FURTHER CONSIDERATION

The following issues were eliminated from further analysis for the reasons stated below.

Cultural Landscapes – Evaluated in 1984, the landscape associated with the Fort Spokane is managed as a historic cultural landscape reflecting the military period from 1880 to 1899. A level II inventory of the cultural landscape at Mission Point is being completed. It is possible that other potentially eligible landscapes could be either outside the study area or in areas already experiencing heavy visitor use from other sources. The impacts (if any) resulting from PWC users would be extremely difficult to distinguish or quantify.

Historic Structures – Currently, 37 structures are on the national recreation area's List of Classified Structures, all of which relate to the structures already listed or determined eligible for listing on the national register. Given that the majority of historic structures within the park are either located outside the study area or in areas already experiencing heavy visitor use from other sources, the impacts (if any) resulting from personal watercraft would be extremely difficult to distinguish or quantify.

Museum Collections – The annual performance plan for Lake Roosevelt National Recreation indicates that the park has over 13,600 museum objects cataloged. The artifact collection is being stored in facilities at Nez Pierce National Historical Park. Given the collection's location, there would be no impacts from PWC use in the national recreation area to this cultural resource.

Ethnographic / Sacred Sites – While ethnographic resources or sacred sites have not yet been formally evaluated for their status as traditional cultural properties / sacred sites, the *General Management Plan* (NPS 2000c) indicates that over 400 sites have been recorded. It is possible that potentially eligible resources could be either outside the study area or in areas already experiencing heavy visitor use from other sources. The impacts (if any) resulting from PWC users would be extremely difficult to distinguish or quantify.

Paleontological Resources – While this section of the upper Columbia River has seen continuous human occupation for more than 9,000 years, little is known about the paleontological resources of the park beyond their existence and general location. It is possible that potentially eligible resources could be either outside the study area or in areas already experiencing heavy visitor use from other sources. However, the impacts (if any) resulting from the PWC users would be extremely difficult to distinguish or quantify.

Floodplains – The level of PWC use and associated PWC activities identified in each alternative would have no adverse impacts on floodplains. No development is proposed in the alternatives; thus, no flooding would result as a result of PWC use and cause impacts to human safety, health, or welfare.

Prime and Unique Agricultural Lands – No prime and unique agricultural farmland exists in the vicinity of areas that would be affected by PWC use.

Energy Requirements and Natural or Depletable Resource Requirements – PWC operation requires the use of fossil fuels. While PWC use could be limited or banned within this park unit, no alternative considered in this environmental assessment would affect the number of personal watercraft used within the region or the amount of fuel that is consumed by personal watercraft. The level of PWC use considered in this environmental assessment is minimal. PWC use would not have an adverse effect on continued fuel availability.

RELATIONSHIP TO OTHER PLANS, POLICIES, AND ACTIONS

The following plans, policies, and actions could affect the alternatives being considered for personal watercraft. These plans and policies are also considered in the analyses of cumulative effects.

PARK PLANS, POLICIES, AND ACTIONS

2000 General Management Plan – Various management issues including PWC use were discussed throughout the development of the new *General Management Plan* (NPS 2000c) for the recreation area. The planning process started in January 1997 and was completed in January 2000. Lake users, local and tribal governments, conservation interests, the state's Congressional delegation and the general public were consulted extensively throughout the development of the GMP.

Boating, including PWC use, was discussed at public meetings, in newsletters, and in the draft and final GMP and associated Environmental Impact Statement. Many people felt that the level of boating and the quality of the experience were acceptable and that no major changes in management were needed. A few felt that there are too many people who do not respect the regulations and create safety problems by speeding and operating their crafts in an unsafe manner. They felt that the National Park Service should increase its enforcement capabilities.

Most people thought that despite some problem areas, the level of boating activity on the lake was acceptable and that, due to the size of the reservoir, there was still room for visitors to seek and find whatever type of experience that they prefer. Noise was identified as a problem in confined spaces such as in the Spokane Arm of the lake. The predominant sentiment expressed by the public regarding PWC use on Lake Roosevelt during the development of the GMP was "educate first, regulate as needed." The final plan, completed prior to the PWC closure, adopted the approach of allowing PWC use to continue subject to additional controls as needed.

2002 Superintendent's Compendium – Annual compendiums are composed by park superintendents to detail specific regulations applicable to a variety of topics within park units. The 2002 Lake Roosevelt National Recreation Area Superintendents Compendium outlines regulations relevant to recreation and land use within the park. Boating operations provisions that are applicable to personal watercraft that are mentioned in the compendium include flat-wake or passive water designations on Crescent Bay Lake, Hawk Creek, and the Kettle River.

2000 Strategic Plan, Fiscal Years 2001–2005 – The *Strategic Plan* addresses topics such as the mission of Lake Roosevelt National Recreation Area and goals for accomplishing and maintaining the mission. Strategies for achieving these goals are discussed, as well as long-term goals for the 5-year period covered in the plan. Mission goals of the park fall under four categories:

- Preserve park resources.

- Provide for the public use, enjoyment, and visitor experience of the park.
- Strengthen and preserve natural and cultural resources and enhance recreational opportunities managed by partners.
- Ensure organizational effectiveness.

These goals have been incorporated into the development of objectives and alternatives presented in this environmental assessment.

Future Park Plans and Actions – Future park plans and/or actions that may affect or be related to PWC use include plans to add a concession marina at Crescent Bay, a small concession facility at Hunters boat launch area, and a potential relocation of the Kettle Falls Marina to a deep water area just upstream from the current location. There are also plans currently under review in an Environmental Assessment for facility improvements to the Bradbury Beach swim beach and parking area (NPS 2002b). All of the above plans are consistent with management strategies in the *General Management Plan* (NPS 2000c).

LOCAL, STATE, OR OTHER POLICIES, PLANS, OR ACTIONS

Other than state boating regulations, no local actions or laws have been established by surrounding communities, counties, or the State of Washington that affect PWC use at Lake Roosevelt. There are no regulations or policies on adjacent tribal waters on Lake Roosevelt that affect PWC use on NPS portions of the lake.

ALTERNATIVES

All alternatives must be consistent with the purpose and significance of Lake Roosevelt National Recreation Area, and they must meet the purpose of and need for action, as well as the objectives for the project. Three alternatives are described in this section, as well as alternatives that were considered but dismissed.

The alternatives analyzed in this document in accordance with the *National Environmental Policy Act* are the result of agency scoping and public scoping input from the *2000 General Management Plan* (NPS 2000c) process, and as stipulated in the settlement agreement between the Bluewater Network and the National Park Service. The action alternatives address the reinstatement of PWC use under a special regulation. Under the no-action alternative personal watercraft would not be reinstated because the National Park Service would not take action to draft a special regulation to allow PWC use.

Table 3 summarizes the alternatives being considered, table 4 summarizes the impacts of each alternative, and table 5 analyzes how the alternatives meet the project objectives (as identified in the "Purpose of and Need for Action" chapter). These three tables are located at the end of this chapter.

ALTERNATIVE A: REINSTATE PWC USE UNDER A SPECIAL NPS REGULATION AS PREVIOUSLY MANAGED

Under alternative A, a special NPS regulation would be written to reinstate PWC use as managed prior to November 6, 2002. PWC use would be managed in accordance with NPS *Management Policies 2001,* park practices, and state regulations with no added restrictions. In accordance with the *2000 General Management Plan* (NPS 2000c), this alternative would allow PWC use within the recreation area. The numbers of personal watercraft would be unrestricted.

Areas of Use. PWC use would continue in accordance with management policies that were in place prior to the November 6, 2002, ban on personal watercraft within the NPS portion of Lake Roosevelt. PWC use would be allowed throughout the recreation area, with limitations only in areas where restrictions currently exist. These areas include the following:

- Crescent Bay Lake (motorized watercraft restricted)
- Upper Kettle River, above the Napoleon Bridge (flat wake)
- Upper Hawk Creek from the waterfall near the campground through the area known as the "narrows" (flat wake)

PWC use would continue to be allowed on those portions of Lake Roosevelt managed by the Colville Confederated Tribes and Spokane Tribe of Indians (map 2). The National Park Service would provide assistance, as needed, in monitoring potential impacts within tribal waters related to the reinstatement of PWC use. Special regulations governing PWC use on Lake Roosevelt would only apply to waters managed by the National Park Service.

Equipment and Emissions. As noted in the introduction, the Environmental Protection Agency promulgated a rule to control exhaust emissions from new marine engines, including outboard and PWC engines. Emission controls provide for increasingly stricter standards beginning in model year 1999 (EPA 1996a, 1997). Under this alternative, it is assumed that over time, PWC two-stroke engines would be converted to cleaner direct-injection or four-stroke engines in accordance with industry compliance with

the EPA rule (40 CFR Parts 89-91, "Air Pollution Control; Gasoline Spark-Ignition and Spark-Ignition Engines, Exemptions; Rule," 1996). It is the responsibility of the PWC industry to meet these regulations, not the responsibility of individual owners.

Launch Restrictions. Launch and retrieval of personal watercraft would continue to be permitted only at designated boat launch ramps within Lake Roosevelt National Recreation Area. PWC users would be able to land anywhere along the shoreline, except at designated swim beaches.

Education. Visitor education programs, such as boater safety education, that are designed to promote safe and environmentally friendly practices would continue. The programs would include personal contacts, newspaper articles and formal educational programs.

Operating Restrictions. All state and federal watercraft laws and regulations would continue to be enforced, including regulations that address reckless or negligent operation, excessive speed, hazardous wakes or washes, hours of operation, age of driver and distance between vessels. The state requires all PWC riders to wear a Coast Guard approved personal floatation device and a lanyard cutoff switch, if installed by the manufacturer.

Operators must be at least 14 years old, and it is unlawful to lease, hire, or rent a personal watercraft to any person under 16 years of age. No person shall operate a personal watercraft on the waters of Washington State during the period from sunset until sunrise.

Washington State prohibits reckless behavior, such as that endangers, or is likely to endanger, any person or property. Within 100 feet of marked swimming or boat access areas, vessels shall be operated at the minimum speed necessary to maintain steerageway.

Water patrols and enforcement, in conjunction with cooperating agencies, would continue on an irregular basis during the primary PWC use season (mid-June to Labor Day), with less than a daily occurrence.

ALTERNATIVE B: REINSTATE PWC USE UNDER A SPECIAL NPS REGULATION WITH ADDITIONAL MANAGEMENT PRESCRIPTIONS (PREFERRED ALTERNATIVE)

Under alternative B, a special NPS regulation would be written to reinstate PWC use at Lake Roosevelt National Recreation Area. Under this alternative, the following provisions would remain the same as those listed above for alternative A: areas of use/location restrictions; launch restrictions; equipment and emissions; education; and safety-operating restrictions. In alternative B, PWC use would be managed to mitigate watercraft safety concerns, visitor health and safety, and to enhance overall visitor experience through the following additional restrictions:

Wake Restrictions. The current draft of 36 CFR 3 defines "flat-wake speed" as a minimal disturbance of the water by a vessel in order to prevent damage or injury. Operation of personal watercraft would only be allowed to occur at flat-wake speeds in the following locations:

- within 200 feet of launch ramps, marina facilities, campground areas, swim beaches, water skiers, or other persons in the water;
- the stretch of the Spokane Arm from 100 feet west of the Two Rivers Marina on the downstream end, to 100 feet east of the launch ramp on the upstream end, above the vehicle bridge (map 3).

Monitoring of PWC effects. In conjunction with tribes, state and counties, the National Park Service would establish a monitoring program to determine if and when additional regulations are needed should impacts to natural and/or cultural resources or public safety be detected due to an increase in PWC use. Water quality sampling for watercraft emissions in areas of high PWC use would be included in the monitoring program. In the future, PWC use could be discontinued in specific areas managed by National Park Service that experience cultural or natural resource degradation or public safety issues as determined through monitoring of such areas.

NO-ACTION ALTERNATIVE: CONTINUE PROHIBITION OF PWC USE ON NPS-MANAGED WATERS OF LAKE ROOSEVELT

The no-action alternative would continue the prohibition of PWC use at Lake Roosevelt National Recreation Area that began on November 6, 2002, as required by the court order. The National Park Service would take no further action to draft a special regulation allowing PWC use to continue (map 4). However, PWC use would continue outside the boundaries of the national recreation area, in waters of Lake Roosevelt that are under the jurisdictions of the Colville Confederated Tribes and Spokane Tribe of Indians. The National Park Service would enforce the ban on PWC use within its waters with existing staff.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED FURTHER

Because of the split jurisdiction on Lake Roosevelt where control of the water surface is divided between the National Park Service and two Indian Tribes, it is incumbent upon the National Park Service to attempt to develop management options that are generally consistent with efforts underway by the managing partners. Since neither tribe has indicated that they intend to adopt rules pertaining to PWC use at this time, the National Park Service has not attempted to consider further any means of joint management on the lake. Special regulations that may be selected by the National Park Service to manage PWC use would not have any bearing on waters managed by the two tribal entities.

Accelerated engine conversion. Implementing a ban in either 2006 or 2012 on two-stroke carbureted PWC engines was considered as an alternative. However, due to the split jurisdiction of the reservoir between National Park Service and tribal entities, enforcement of such a ban would not be feasible.

THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is defined by the Council on Environmental Quality as the alternative that best meets the following criteria or objectives, as set out in section 101 of the *National Environmental Policy Act*:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Ensure for all Americans a safe, healthful, productive, and aesthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, whenever possible, an environment that supports diversity and variety of individual choice.

- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities.

- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

This discussion summarizes the extent to which each alternative meets section 102(1) of the *National Environmental Policy Act*, which asks that agencies administer their own plans, regulations, and laws so that they are consistent with the policies outlined above to the fullest extent possible.

Alternative A would satisfy the majority of the six requirements detailed above; however, alternative A would not ensure for safe, healthful, productive, and aesthetically pleasing surroundings by allowing PWC use in areas frequented by non-PWC recreationists. Of the alternatives analyzed, alternative A would not attain the widest range of beneficial uses of the environment while minimizing degradation, risk of health or safety, or other undesirable and unintended consequences because of the potential impacts of PWC use to visitor experiences, natural resources, and other opportunities in the national recreational area. For this reason, alternative A is not preferred from an environmental perspective.

Alternative B would have impacts on the national recreational area's natural resources similar to those under alternative A. However, alternative B would better meet park goals with respect to the protection of visitor experience and safety by implementing flat-wake restrictions in areas of high visitor activity. Additionally, benefits to natural resources under alternative B would result from the implementation of a resource monitoring program. In the long term, this alternative would help visitors enjoy a beneficial use by allowing access to national recreation area amenities by PWC users while accommodating other recreationists and meeting resource management objectives. This alternative would accommodate recreational opportunities for visitors while protecting sensitive natural resources. Alternative B is designed to meet the NPS general prohibition on PWC use for the protection of park resources and values while providing recreational opportunities for PWC users.

The no-action alternative would ensure a safe, healthful, productive, and aesthetically and culturally pleasing area for visitors to access without the threat of PWC users introducing noise and safety concerns. The no-action alternative would attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences by removing the PWC use from the national recreation area entirely. However, the no-action alternative would not maintain an environment that supports diversity and variety of individual choice, nor would it achieve a balance between population and resource use that permits a wide sharing of amenities.

Based on the analysis prepared for PWC use at Lake Roosevelt National Recreation Area, alternative B is considered the environmentally preferred alternative by best fulfilling park responsibilities as trustee of sensitive habitat; by ensuring safe, healthful, productive, and aesthetically and culturally pleasing surroundings; and by attaining a wider range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.

TABLE 3: SUMMARY OF ALTERNATIVES

PWC Management Action	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Areas of Use	No motorized watercraft use on Crescent Bay Lake.	No motorized watercraft use on Crescent Bay Lake. Future limits may be applied if deemed necessary in specific portions of waters managed by the National Park Service.	Not applicable. Personal watercraft would continue to be prohibited from operating in NPS-managed waters of Lake Roosevelt.
Wake Restrictions	Current flat-wake areas include: • The upper Kettle River, above the Napoleon Bridge • Hawk Creek from the narrows upstream to the waterfall.	In addition to the current flat-wake areas in alternative A, flat-wake zoning would apply to the following: • within 200 feet from: – launch ramps, – marina facilities, – campgrounds, – swim beaches, – water skiers and other persons in the water. • the Spokane Arm from 100 feet west of the Two Rivers Marina on the downstream end, to 100 feet east of the launch ramp on the upstream end, above the vehicle bridge. Applicable only to waters managed by the National Park Service.	Not applicable.
Launch Restrictions	Launch and retrieval of personal watercraft would be permitted only at designated boat launch ramps. Personal watercraft would be able to land anywhere along the shoreline, except at swim beaches.	Same as alternative A.	Not applicable.
PWC Numbers	No limits.	No limits, but may apply limits in future if monitoring deems necessary for protection of resources or public safety. Applicable only to waters managed by the National Park Service.	Not applicable.
Safety/Operating Restrictions			
Flotation Device	Per state boating regulations, require all PWC riders wear USCG approved Type I, II, III, or V personal flotation device.	Same as alternative A.	Not applicable.
Lanyard/Cut-off	Per state boating regulations, PWC operators required to have lanyard/cut-off devices, if installed.	Same as alternative A.	Not applicable.
Age Restriction	Per state boating regulations, PWC operators must be at least 14 years of age. It is unlawful to lease, hire, or rent a personal watercraft to any person under 16 years of age.	Same as alternative A.	Not applicable.
Time Restrictions	Per state boating regulations, no operation of personal watercraft during the period from sunset until sunrise.	Same as alternative A.	Not applicable.

PWC Management Action	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Reckless Behavior	Per state boating regulations, operators of personal watercraft shall not conduct themselves in a reckless manner that endangers any person or property. Within 100 feet of marked swimming or boat access areas, personal watercraft shall be operated at the minimum speed necessary to maintain steerageway.	Same as alternative A.	Not applicable.
Education	Visitor education programs would continue, including boater safety education.	Same as alternative A.	Same as alternative A.
Equipment and Emissions	PWC two-stroke engines would be converted to cleaner direct-injection or four-stroke engines in accordance with the EPA rule regulating industry emission standards. It is the responsibility of the PWC industry to meet these regulations, not the responsibility of individual owners.	Same as alternative A.	Not applicable.

TABLE 4: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Water Quality	Alternative A would have negligible adverse effects on water quality based on ecotoxicological threshold volumes due to the reinstatement of PWC use in NPS-managed waters at Lake Roosevelt. Cumulative pollutant loads in 2002 and 2012 from personal watercraft and other motorboats would be well below ecotoxicological benchmarks and criteria. Adverse water quality impacts from personal watercraft from benzo(a)pyrene, benzene and MTBE based on human health (ingestion of water and fish) benchmarks would be negligible in both 2002 and 2012, based on EPA and state of Washington water quality criteria. Cumulative impacts from personal watercraft and other watercraft would be negligible adverse and long-term for benzo(a)pyrene, benzene and MTBE. Cumulative impacts from personal watercraft and other motorboats to water quality would also be applicable to tribal managed waters. Implementation of alternative A would not result in an impairment of the water quality resource.	The adverse impacts to water quality from alternative B would be the same as alternative A. Although additional flat-wake restrictions would be implemented in some areas, effects from low throttle operation would not measurably change water quality impacts to NPS-managed waters. PWC use under alternative B would have negligible adverse effects on water quality based on ecotoxicological threshold volumes. Cumulative pollutant loads in 2002 and 2012 from personal watercraft and other motorboats would be well below ecotoxicological benchmarks and criteria. Adverse water quality impacts from personal watercraft from benzo(a)pyrene, benzene and MTBE based on human health (ingestion of water and fish) benchmarks would be negligible in both 2002 and 2012, based on EPA and state of Washington water quality criteria. Cumulative adverse impacts from personal watercraft and other watercraft would be negligible for benzo(a)pyrene, benzene and MTBE. Cumulative impacts from personal watercraft and other motorboats to water quality would also be applicable to tribal managed waters. Implementation of alternative B would not result in an impairment of the water quality resource at Lake Roosevelt.	PWC use would not be reinstated within NPS-managed waters of Lake Roosevelt, resulting in long-term beneficial impacts due to the elimination of pollutant loads in these waters from personal watercraft. Cumulative impacts from motorboats would be negligible and long term for all ecotoxicological and human health benchmarks, as in other alternatives. The contribution of PWC to cumulative impacts in NPS-managed waters would be eliminated. Cumulative impacts from motorized boats would be negligible and long term for all ecotoxicological and human health benchmarks, as in other alternatives. Continued PWC use on tribal managed waters would contribute to negligible adverse cumulative impacts from watercraft activity to quality of waters under tribal jurisdiction. Implementation of this alternative would not result in an impairment of the water resource.
Air Quality			
Impact to Human Health from Airborne Pollutants Related to PWC Use	PWC use in NPS-managed waters would result in negligible adverse impacts to human heath related to the airborne pollutants HC, PM_{10} and NO_x, and minor adverse impacts from CO for the year 2002. The risk from PAH would also be negligible. In 2012, there would be a negligible increase in NO_x emissions and a decrease in emissions of the other pollutants, although the impact level for these pollutants would remain the same as in 2002. Cumulative emission levels from boating use on NPS-managed waters of Lake Roosevelt would be negligible for PM_{10}, and moderate for HC and CO in 2002 and 2012. NO_x emissions would be negligible in 2002 and minor in 2012. CO and NO_x emissions would increase from 2002 to 2012 because of	Alternative B would result in the same air quality impacts to human health from PWC emissions as alternative A. Additional management prescriptions would not noticeably affect PWC emissions. As in alternative A, negligible adverse impacts for HC, PM_{10} and NO_x, and minor impacts for CO would occur for 2002 and 2012. The risk from PAH would also be negligible in 2002 and 2012. Cumulative adverse impacts from PWC and other boating emissions within the national recreation area would be the same as for alternative A, and would be moderate for CO and	PWC use would not be reinstated within the national recreation area, resulting in long term, beneficial impacts in localized areas due to the elimination of CO, PM_{10}, HC, and NO_x emissions from personal watercraft. PWC contribution to cumulative air quality impacts on NPS-managed waters would also be eliminated. Cumulative impacts to human health from the remaining motorized boats operating in NPS waters would be negligible for PM_{10} and NO_x and moderate for CO and HC in 2002. In 2012, impacts would be the same except for an increase in the impact of NO_X to minor levels due to cleaner engines and increased boating

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
	increased boating activity and cleaner engines that have higher CO and NO_x emissions. Although there would be an increase in NO_x emissions in 2012, the greater reduction in HC emissions would result in a beneficial impact to regional ozone concentrations. Therefore, this alternative would maintain or improve existing air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. Overall, PWC emissions of HC are estimated to be 10% to 11% of the cumulative boating emissions in 2002 and 2012. Cumulative impacts from watercraft emissions would also be applicable to adjacent areas under tribal jurisdiction. All impacts would be long term. Implementation of this alternative would not result in an impairment of air quality.	HC, and negligible for PM_{10} and NO_x in 2002. In 2012, NO_x impact would increase to minor; impacts for the other pollutants would remain at 2002 levels. A beneficial impact to regional ozone emissions would occur due to a reduction in HC emissions. This alternative would maintain or improve existing human health air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. The PWC contribution to emissions of HC is estimated to be 10% to 11% of the cumulative boating emissions in 2002 and 2012. Cumulative impacts from watercraft emissions would also be applicable to adjacent areas under tribal jurisdiction. All impacts would be long term. Implementation of this alternative would not result in an impairment of air quality.	activity. These cumulative emissions would be reduced relative to other alternatives due to the elimination of PWC within the national recreation area, although some of this use would be displaced to tribal waters. Cumulative impacts to tribal managed areas would continue to include impacts from PWC use. Cumulative impacts from other motorized boats would be the same in tribal managed areas as in areas under NPS jurisdiction. All impacts would be long term. Implementation of this alternative would not result in an impairment of air quality.
Air Quality Related Values from PWC Pollutants	Negligible long-term adverse impacts to air quality related values would occur from personal watercraft operating on NPS-managed waters in 2002 and 2012. This conclusion is based on pollutant emissions of less than 50 tons per year, no observed visibility impacts or ozone-related plant injury, and low regional SUM06 values. Cumulative emissions from motorized boats and personal watercraft in both 2002 and 2012 would result in moderate adverse impacts to air quality related values. Although HC emissions would exceed 100 tons per year in 2002 and 2012, and NO_x emissions would exceed 50 tons per year in 2012, these emissions are representative of historic values and have not contributed to elevated SUM06 levels or observed visibility impacts or ozone-related plant injury. There would be beneficial effects to ozone levels in 2012 resulting from the expected reduction in HC emissions from new engine technology. Cumulative impacts would also be applicable to tribal managed areas. Implementation of this alternative would not result in an impairment of air quality related values.	The impacts of alternative B would be the same as alternative A. Alternative B would have long-term negligible adverse impacts to air quality related values from personal watercraft and moderate adverse impacts from cumulative emissions from motorized boats and personal watercraft in both 2002 and 2012. This conclusion is based on calculated levels of pollutant emissions. There are no observed visibility impacts or ozone-related plant injury in the recreation area. Cumulative impacts would also be applicable to tribal managed areas. Implementation of this alternative would not result in an impairment of air quality related values.	Emissions from PWC use within the national recreation area and their contribution to impacts on air quality related values would be eliminated. Cumulative adverse impacts to air quality related values from other motorized boat use would be moderate and long-term and would apply to both NPS- and tribal-managed areas. Continued PWC use on tribal managed waters would also contribute negligible impacts to overall cumulative impacts for both NPS- and tribal-managed areas. This conclusion is based on regional SUM06 values, the lack of existing or anticipated local ozone or visibility effects, and the calculated pollutant emission levels.
Soundscapes	Noise from personal watercraft would have short-term minor to moderate adverse impacts at most locations at Lake Roosevelt National Recreation Area and the immediate surrounding area. Impacts would be related to the number of personal watercraft	Noise from personal watercraft would have minor to moderate adverse impacts at most locations at Lake Roosevelt National Recreation Area and the immediate surrounding area. Impact levels would relate to the	Noise experienced at the national recreation area would be decreased in comparison to alternatives A and B due to the elimination of PWC use in NPS-managed waters. There would be occasionally noticeable beneficial

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	operating as well as the sensitivity of other visitors, and would be highest during summer weekends and holiday periods during periods of peak use. Cumulative adverse noise impacts from personal watercraft and other watercraft, automobiles, aircraft, and lumber operations would be minor to moderate, and would predominate on busy days during the high use season. Impacts would be long-term because of the high volume of annual boating use. Cumulative impacts to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas. Non-watercraft visitor use would have a negligible adverse impact on the soundscape at Lake Roosevelt. Implementation of this alternative would not result in an impairment of the park's soundscape.	number of personal watercraft operating as well as the sensitivity of other visitors. Flat-wake restrictions would have beneficial impacts to some park visitors from reduced noise levels. Cumulative adverse noise impacts from personal watercraft and other watercraft, automobiles on SR 25, aircraft, lumber operations, and other visitor activities would be minor to moderate because these sounds would be heard occasionally throughout the day, and may predominate on busy days during the high use season. Cumulative impacts to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas. Implementation of this alternative would not result in an impairment of the park's soundscape.	effects on the soundscape of the areas of the park where personal watercraft have traditionally operated. Cumulative noise impacts including those from motorized boats and other visitor activities as well as personal watercraft on adjacent tribal managed waters would have a long-term, minor to moderate adverse impact on the soundscape of the park. Cumulative impacts on the tribal soundscape would be similar, but with a continued contribution from PWC use on tribal managed waters. Implementation of this alternative would not result in an impairment of the park's soundscape.
Wildlife and Wildlife Habitats	PWC use within NPS-managed areas at Lake Roosevelt would have negligible to minor adverse impacts on fish, waterfowl, and other wildlife. Due to low levels of PWC use in the recreation area, coupled with a lack of prime habitat areas at the shoreline, any impacts to fish, wildlife and respective habitats would be temporary and short term. The intensity and duration of impacts is not expected to increase substantially over the next 10 years, since PWC numbers would not increase substantially and engine technology would continue to improve under EPA industry regulations. Cumulative impacts from motorized boating and other visitor activities would have short-term, minor adverse effects on wildlife and wildlife habitat. Lake operations also contribute to cumulative impacts through fluctuations in water level and potentially would cause minor to moderate adverse impacts to fish, and beneficial or adverse impacts to riparian and wetland areas that provide habitat for wildlife. Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas. Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.	The reinstatement of PWC use with flat-wake restrictions and the establishment of a resource monitoring program would have beneficial impacts to wildlife due to the decreased noise and disturbance from personal watercraft and the ability to mitigate future impacts. Despite these benefits, impacts to wildlife and wildlife habitat would be adverse negligible to minor in 2002 and 2012, similar to alternative A. All wildlife impacts from personal watercraft would be temporary and short term. Cumulative adverse impacts from motorized boats and other visitor activities would be negligible to minor as under alternative A. Lake operations would also contribute to cumulative adverse impacts through minor to moderate levels of long-term habitat disturbance. Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas. Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.	PWC use would not be reinstated in NPS-managed waters on Lake Roosevelt, resulting in beneficial impacts on wildlife and wildlife habitat due to the elimination of interactions between PWC users and wildlife within the national recreation area. Cumulative adverse impacts on wildlife and wildlife habitat in the national recreation area would be short-term negligible to minor due to other visitor activities and minor to moderate from lake operations. PWC use would continue to contribute to cumulative adverse impacts on tribal managed wildlife and habitat resources because PWC use would continue on tribal managed waters of Lake Roosevelt. Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.

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Threatened, Endangered, or Special Concern Species	PWC use at Lake Roosevelt may affect, but is not likely to adversely affect the following species with federal or state status: bald eagle, bull trout, California bighorn sheep, American peregrine falcon, American white pelican, black tern, moose, least bladdery milkvetch, Nuttal's pussytoes, or giant helleborine. There would be no effect to all other federal or state listed species including the Canada lynx, gray wolf, grizzly bear, woodland caribou, Ute ladies'-tresses, or Columbia crazyweed. The identified special status species are either not permanent residents who are present during times of PWC use, do not have preferred habitat in the areas used by personal watercraft, are not usually accessible, or are generally acclimated to human activity. Similarly, cumulative effects from all park visitor activities within the national recreation area and lake operations may affect, but would not likely cause adverse effects to special status species due to lack of species occurrences and access to their habitats. Implementation of this alternative would not result in an impairment of threatened or endangered species.	Reinstatement of PWC use within the national recreation area with additional management strategies may affect, but is not likely to adversely affect, any of the listed wildlife or plant species. The potential for effects is less than under alternative A due to establishment of a resource monitoring program. While some disturbance could occur from PWC use, other visitor activities on the lake and shoreline, and lake operations, these cumulative impacts would not be of sufficient duration or intensity to cause adverse impacts. No impacts would occur in designated areas where personal watercraft would be prohibited or where additional speed or flat-wake restrictions would be enforced. Implementation of this alternative would not result in an impairment of threatened or endangered species.	PWC users would not be allowed to operate in NPS-managed waters on Lake Roosevelt, resulting in elimination of potential effects to special status species and habitat from PWC use within the national recreation area. PWC use would continue on portions of Lake Roosevelt not managed by the National Park Service, and may affect, but is not likely to affect, any of the listed wildlife or plant species. Any impacts from personal watercraft would be short term. Cumulative effects from lake operations and non-PWC watercraft use and other visitor activities would be similar to other alternatives, and may affect, but are not likely to adversely affect special status species. Implementation of this alternative would not result in an impairment of threatened or endangered species.
Shoreline Vegetation	PWC use would result in negligible adverse effects on shoreline vegetation because shoreline vegetation is generally lacking. Sensitive wetland and riparian areas are located in inaccessible or protected areas with regulated PWC access. Watercraft activity could cause negligible adverse impacts to shorelines through watercraft-induced wave action or visitor access. Wind-caused wave action and lake level fluctuation could cause negligible impacts through erosion to the shoreline of the open areas of the reservoir. Lake level fluctuations could also potentially have minor adverse impacts to sensitive vegetation in side drainages. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas. Implementation of this alternative would not result in an impairment of shoreline vegetation.	Impacts to shoreline vegetation would be the same as alternative A, although some benefit could result from resource monitoring if sensitive vegetation communities become established. Cumulative adverse impacts from motorized boats and other watercraft, other visitor activities, and wind-caused wave action would remain negligible, while impacts from lake level fluctuations would be negligible to minor. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas. Implementation of this alternative would not result in an impairment of shoreline vegetation.	PWC use would not be reinstated within the recreation area, resulting in the elimination of personal watercraft from NPS-managed waters and some beneficial impacts to shoreline vegetation similar to alternative B. Cumulative impacts from watercraft activity, other visitor uses and physical processes would continue, and would be negligible to minor, although the long-term PWC contribution to these impacts would be eliminated along NPS shorelines. The above cumulative impacts would also be applicable to tribal managed shorelines. In addition, PWC use would continue to contribute to cumulative impacts to tribal managed shorelines. Implementation of this alternative would not result in an impairment of shoreline vegetation.

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Visitor Use and Experience	Reinstated PWC use at Lake Roosevelt National Recreation Area would cause negligible to minor adverse impacts on experiences for most visitors to the national recreation area in the short and long-term. Swimmers and other shoreline users would be most affected by PWC use at popular day-use areas used by personal watercraft, such as Crescent Bay, Spring Canyon, Porcupine Bay, Fort Spokane, and Bradbury Beach. PWC use would have negligible to minor adverse impacts on other boaters due to increased congestion at popular boat launches. PWC use would have long-term, negligible to minor adverse impacts on swimmers and those visitors desiring natural quiet. Cumulative effects of PWC use, other watercraft, and other visitors would result in short- and long-term, negligible to minor adverse impacts on visitor experience goals. Plans for future expansion or improvements to visitor facilities within the national recreation area would have long-term beneficial impacts on visitor experience. These cumulative impacts would also be applicable to adjacent tribal managed visitor use areas.	Designation of the flat-wake zones would have negligible to minor adverse impacts on most PWC users within the national recreation area since these areas would not be available for high-speed maneuvering; however, all of the lake surface would still be accessible to PWC users. Other boaters and shoreline users would experience beneficial impacts, especially at launch areas and high-use facilities. Swimmers, water skiers, and other persons in the water would experience beneficial impacts on their experience. Cumulative effects of PWC use, other motorized boats, and other visitors would result in long-term, negligible to minor adverse impacts, while plans to improve or expand facilities would have long-term beneficial impacts on visitor experience within the national recreation area. Cumulative impacts from PWC use, motorized boats, and other visitors would also be applicable to adjacent tribal managed visitor use areas.	The continued ban of personal watercraft on NPS-managed waters would have a beneficial impact on the experiences of most non-PWC visitors to the national recreation area, and minor to moderate adverse impacts on visitors to tribal-managed launch facilities due to increased crowding. Impacts on all PWC users would be long term, moderate, and adverse. Cumulative impacts would include a negligible long-term adverse effect on PWC users at nearby water bodies that would potentially receive increased PWC use. Plans for future facilities improvements would result in long-term beneficial impacts on visitor experience.
Visitor Conflicts and Safety	Reinstated PWC use within the national recreation area would have negligible to minor adverse impacts on other boaters in the short and long term. Under this alternative, PWC use would have minor to moderate adverse impacts related to conflicts and safety of swimmers, and negligible to minor adverse impacts on other shoreline visitors particularly in the noted high PWC use locations. Cumulative impacts related to visitor conflicts and safety would be minor adverse for all user groups in the short and long term, particularly near the high-use areas. Cumulative impacts in other areas of the lake would be negligible. Cumulative impacts from all visitor user groups to visitors of tribal managed facilities and waters would be similar to those for NPS visitors. Cumulative impacts due to facilities improvements would be beneficial to all visitors within the national recreation area. Overall, most visitors to Lake Roosevelt National Recreation Area would experience minor adverse effects under this alternative.	Reinstated PWC use with additional PWC management prescriptions would have short- and long-term beneficial impacts on visitor conflicts and safety near the designated swim areas, boat launches and marinas, and campgrounds and a beneficial impact on other visitors to Lake Roosevelt National Recreation Area. Cumulative impacts to visitor conflict and safety in tribal managed areas would be the same as in alternative A, as management prescriptions under alternative B would not affect tribal managed areas. Cumulative impacts related to visitor conflicts and safety would be negligible to minor adverse for all NPS user groups in the short and long term, particularly near the high use areas.	Personal watercraft would not be reinstated on NPS-managed waters of Lake Roosevelt. Short- and long-term beneficial impacts would result by eliminating visitor conflicts with PWC use and enhancing safety on NPS-managed waters. Long-term minor to moderate adverse impacts on tribal-managed waters would also occur, due to the expected increase of PWC use on these waters. Cumulative impacts of the various user groups on visitor conflict and safety would be negligible to minor adverse.
Cultural Resources	PWC use within the national recreational area could have minor	Although flat-wake restrictions within the national recreation	Prohibiting PWC use would result in minor beneficial impacts over the

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	adverse impacts on listed or potentially listed archeological sites from possible illegal collection and vandalism or from erosion due to PWC-induced wave action. Cumulative impacts from other visitor use on archeological resources that are readily accessible could be minor to major adverse, due to the number of visitors and the potential for illegal collection or destruction. Lake fluctuations would also potentially cause minor to moderate impacts through erosion. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians would be similarly affected and could experience minor to moderate adverse impacts as a result of PWC and other visitor use. All impacts would occur over the short and long term. Implementation of this alternative would not result in an impairment of cultural resources.	area would reduce wave action in some areas and provide a minor beneficial impact, PWC use could have minor adverse impacts on listed or potentially listed archeological resources from possible illegal collection and vandalism, similar to alternative A. In unrestricted areas, PWC-induced wave action could also have minor adverse impacts on listed or potentially listed archeological sites from erosion. Cumulative impacts from visitor activities on archeological resources that are readily accessible could be minor to major and adverse, due to the number of visitors and the potential for illegal collection or destruction. Lake fluctuations would also potentially cause minor to moderate impacts through erosion. Continuing PWC use under a special regulation is not expected to negatively affect the overall condition of cultural resources due to resource monitoring that would be conducted. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians could experience minor to moderate adverse impacts as a result of PWC and other visitor use. All impacts would occur over the short and long term. Implementation of this alternative would not result in an impairment of cultural resources.	short and long term on archeological sites within the national recreation area. Cumulative impacts from all other visitor activities would continue to be minor to major, depending on the accessibility of the resource and the potential for illegal collection or damage. Lake fluctuations would also continue to cause minor to moderate impacts through erosion. Tribal archeological resources would continue to experience minor to moderate cumulative effects from PWC and other visitor use. All impacts would occur over the short and long term.
Socioeconomic Effects	No change in consumer surplus for PWC users or other visitors. No change in producer surplus to providers of PWC or non-PWC services. No change in welfare to local residents or the general public.	No change in consumer surplus for PWC users. Slight increase in consumer surplus of non PWC visitors. No change in producer surplus of providers of PWC services and slight increase in producer surplus for providers of non-PWC services. No change in welfare to local residents. Slight increase in welfare of the general public.	Decrease in consumer surplus for current and future PWC users. Increases in consumer surplus for non-PWC visitors. Decrease in producer surplus for PWC rental and retail shops. No change in producer surplus for hospitality services. Increase in producer surplus for providers of services to non-PWC park visitors. Increase in welfare to the general public and local residents who do not use PWC. Decrease in welfare to local residents who use PWC.
Environmental Justice	There would be no adverse effects related to environmental justice since reinstating PWC use within the national recreation area would not disproportionately affect minority or low income populations. Recreational use facilities managed by the Indian Tribes would continue to be available to PWC	Impacts related to environmental justice, both adverse and beneficial, would be the same as for alternative A and there would be no adverse effects related to environmental justice since reinstating PWC use within the national recreation area would	Under the continued prohibition of PWC use on NPS-managed waters, PWC use would be displaced onto the tribal side of the lake, potentially resulting in negligible to minor adverse impacts on tribal enforcement costs. Minor beneficial impacts could result from

Impact Topic	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
	users, providing long-term beneficial impacts to tribal managed facilities on both NPS and tribal lands from the reinstatement of PWC use. Reduced conflicts with other watercraft would result from the dispersion of PWC use from tribal waters to other areas of the lake, resulting in a long-term beneficial impact.	not disproportionately affect minority or low income populations. Recreational use facilities managed by the Indian Tribes would continue to be available to PWC users, providing long-term beneficial impacts to tribal managed facilities on both NPS and tribal lands from the reinstatement of PWC use. Reduced conflicts with other watercraft would result from the dispersion of PWC use from tribal waters to other areas of the lake, resulting in a long-term beneficial impact.	PWC users' increased spending at the Two Rivers Marina. Displacement of PWC use could also increase disturbances to naturally and culturally sensitive areas, resulting in a long-term negligible to minor adverse impact to tribal managed lands and waters. Minor to moderate adverse impacts could also affect the marinas on NPS-managed lands that are managed by the Confederated Tribes of the Colville Reservation.
National Recreation Area Management and Operations			
Conflicts with State and Local Regulations	Under this alternative, management of PWC regulations within the national recreation area would include NPS and state regulations. Waters adjacent to the recreation area are under the jurisdiction of the Confederated Tribes of the Colville Reservation and the Spokane Tribe of Indians. Reinstated PWC use under alternative A would be managed as it was prior to the ban in November of 2002 and would not result in conflicts with state or tribal regulations. Therefore, adverse impacts (including cumulative impacts) would be negligible.	PWC management prescriptions under alternative B would apply only within the recreation area's NPS jurisdictional boundary and would differ from tribal regulations in adjacent waters. These conflicts with tribal PWC regulations would potentially cause negligible to minor adverse impacts, mainly to PWC users and enforcement staff on Lake Roosevelt. There would be no conflict with other federal, state, or local PWC regulations or policies, and adverse impacts would be negligible.	Continuing the ban on PWC use within NPS-managed waters of Lake Roosevelt would not result in conflict with state or local PWC regulations or policies at surrounding water bodies where PWC use occurs. Therefore, adverse impacts related to such conflicts (including cumulative impacts) would be negligible. However, minor to moderate adverse impacts would occur due to conflict with tribal policies on Lake Roosevelt. PWC use would continue to be allowed on tribal waters while a ban would be enforced on adjacent NPS-managed waters and facilities.
Impact to Park Operations from Increased Enforcement Needs	This alternative would have negligible adverse impacts on park operations and enforcement would continue at current levels.	Alternative B would have negligible to minor adverse impacts on park operations. Staffing would continue at current levels, though increased enforcement efforts would be required to implement flat-wake zoning. Additional educational efforts would also be required to inform PWC users of new regulations.	This alternative would have minor to moderate adverse impacts on park operations. No additional staff, funding, or equipment beyond what has been requested would be secured to ensure compliance with the PWC ban and to regulate existing boating use. Staff would initially need to spend more time and effort educating visitors until they became fully aware of the PWC ban. Under the no-action alternative, it would be likely that some PWC users would operate illegally within the recreation area.

TABLE 5: ANALYSIS OF HOW ALTERNATIVES MEET OBJECTIVES

Issue	Objective	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
Water Quality				
The vast majority of personal watercraft in use today are two-stroke, carbureted engines, which discharge as much as 30% of their fuel directly into the water (NPS 1999; CARB 1999). Hydrocarbons, including BTEX, are also released, as well as MTBE. These discharges have potential adverse effects on water quality.	Manage PWC emissions that enter the water in accordance with NPS anti-degradation policies and goals.	Meets objective due to conversion to cleaner engines that will occur based on EPA industry requirements.	Meets objective due to conversion to cleaner engines that will occur based on EPA industry requirements in addition to expanded resource monitoring efforts.	Fully meets objective.
Some research shows PWC emissions adversely affect water quality via harmful phototoxic effects on ecologically sensitive plankton and other small water organisms (EPA 1998; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). The primary concern is aquatic life and food chains in shallow water ecosystems.	Protect plankton and other aquatic organisms from PWC emissions and sediment disturbances so that the viability of dependent species is conserved.	Meets objective due to conversion to cleaner engines that will occur based on EPA industry requirements in addition to the location of productive shallow water ecosystems away from primary PWC use areas.	Meets objective as in alternative A.	Fully meets objective.
Other potential water quality issues include impacts on drinking water sources from PWC use. Two communities, Grand Coulee and Coulee Dam, use surface water from Lake Roosevelt for drinking water.	Manage PWC emissions so that potable water supplies are not impacted.	Meets objective due to conversion to cleaner engines based on EPA industry requirements.	Meets objective due to conversion to cleaner engines based on EPA industry requirements in addition to monitoring of water quality and other resources under this alternative.	Fully meets objective.
Air Quality				
Pollutant emissions such as nitrogen oxides and hydrocarbons from PWC use may adversely affect air quality. These compounds react with sunlight to form ozone. Although air quality within the park is very good, there is a potential for personal watercraft to cause some localized impacts.	Manage PWC activity so that PWC air emissions of harmful compounds do not appreciably degrade ambient air quality to levels that affect human health and air quality values such as visibility and vegetative health.	Meets objective due to conversion to cleaner engines based on EPA industry requirements.	Meets objective due to conversion to cleaner engines based on EPA industry requirements.	Fully meets objective.
Soundscapes				
Noise limits established by the National Park Service require vessels to operate at less than 82 dB at 82 feet. Personal watercraft may be more disturbing than other motorized	Manage noise from PWC use in affected areas so that visitors' health, safety, and visitor experiences are not	Does not fully meet objective in areas where other recreationists may be sensitive to noise from PWC.	Meets objective due to the 200 foot flat-wake zoning around areas where visitors are concentrated.	Fully meets objective.

Issue	Objective	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
vessels because of rapid changes in acceleration and direction of noise.	adversely affected.			
Wildlife and Wildlife Habitat				
Some research suggests that personal watercraft have a greater impact on waterfowl and nesting birds because of their noise, speed, and ability to access shallow-water areas more readily than other types of watercraft. This may force nesting birds to abandon eggs during crucial embryo development stages and flush other waterfowl from habitat, causing stress and associated behavior changes. Collisions with waterfowl and wildlife may also be of concern.	Protect birds and waterfowl from the effects of PWC-generated noise, especially during nesting seasons.	Meets objective as sensitive areas are protected by flat-wake zoning.	Meets objective as sensitive areas are protected by flat-wake zoning. Enhanced monitoring would assist in recognizing the need for implementation of future restrictions.	Fully meets objective.
Some research suggests that personal watercraft impact wildlife through interruption of normal activities, alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. This is thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow-water-depths. Literature suggests that personal watercraft can access sensitive shorelines, disrupting riparian habitat areas critical to wildlife.	Protect fish and wildlife species (including threatened or endangered species) and their habitats from unnecessary disturbances by personal watercraft.	Does not fully meet objective, potential for disturbance exists in some areas.	Meets objective, as expanded monitoring of resources would assist in recognizing the need for implementation of future restrictions.	Fully meets objective.
Threatened and Endangered Species				
Similar to wildlife, personal watercraft may affect federal listed or other species of concern through interruption of normal activities; alarm or flight; avoidance and displacement of habitat; and effects on reproductive success. At Lake Roosevelt, bald eagle and peregrine falcon are special status species that could potentially be impacted by personal watercraft.	Protect threatened and endangered species, and species of special concern, and their habitats from PWC disturbances.	Meets objective because threatened and endangered species primarily occur during off-season for PWC use and potential impact is minimal.	Meets objective because threatened and endangered species primarily occur during off-season for PWC use and potential impact is minimal. In addition, monitoring of resources would assist in recognizing the need for implementation of future restrictions.	Fully meets objective.
Shoreline Vegetation				
Personal watercraft are often able to access shoreline or shallow water areas where most other watercraft cannot go. This may lead to disturbance of	Manage PWC use to protect sensitive shoreline areas (vegetation/erosion) from PWC activity	Meets objective due to a lack of sensitive shoreline vegetation in areas of PWC use.	Meets objective as in alternative A.	Fully meets objective.

Issue	Objective	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
vegetation resources, including sensitive plant species. In addition, personal watercraft may land on the shoreline allowing visitors to access inland areas where sensitive vegetation and plants species may also exist.	and access.			
Visitor Experience				
Some research suggests that personal watercraft are viewed by some segments of the public as a 'nuisance' due to their noise, speed, and overall environmental effects while others believe personal watercraft are no different from other watercraft and have a 'right' to enjoy the sport.	Manage the potential conflicts between PWC use and park visitors in order to minimize adverse effects to visitor experience.	Does not fully meet objective. Some conflict exists between PWC operators and other park visitors at Lake Roosevelt.	Meets objective with flat-wake restrictions to minimize conflicts between personal watercraft and other lake users.	Does not meet objective. Would lower the satisfaction of PWC owners.
Visitor Conflicts and Safety				
The National Transportation Safety Board reported that in 1996 personal watercraft represented 7.5% of state-registered recreational boats but accounted for 36% of recreational boating accidents. In the same year PWC operators accounted for more than 41% of people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). In part, this is believed to be a "boater education" issue, i.e., inexperienced riders lose control of the craft; but also it is a function of the PWC operation, i.e., no brakes or clutch. When drivers let up on the throttle to avoid a collision, manual steering becomes difficult.	Minimize or reduce the potential for PWC user accidents.	Meets objective with voluntary education programs including boater safety education.	Meets objective as in alternative A.	Fully meets objective.
Due to their ability to reach speeds in the 60 mph range and their ability to access shallow-draft areas, Personal watercraft can create wakes that pose a conflict for both shore and boat fishermen and a safety hazard to other users such as canoeists, kayakers and windsurfers. At Lake Roosevelt National Recreation Area, some complaints by fisherman, canoeists or swimmers are received concerning wakes	Minimize or reduce potential safety issues or conflicts between PWC users and other water recreationists.	Does not fully meet objective. There is some conflict between PWC users and other water recreationists.	Meets objective by establishing flat-wake zoning around other lake users in addition to continued voluntary education programs on boater safety.	Fully meets objective.

Issue	Objective	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
created by personal watercraft. Some complaints are also received concerning the speed of personal watercraft, as well as the speed and noise of "cigarette" boats.				
Cultural Resources				
Some park units may have cultural resources listed, or may be potentially listed (NRHP), that may be affected along shorelines (erosion), or uncontrolled visitor access since riders are able to access, beach, or launch in areas less accessible to most motorized watercraft.	Manage PWC use and access to protect cultural resources including sacred sites important to Native Americans.	Meets objective with continuation of existing regulations protecting cultural resources. Also, lake drawdown does not typically coincide with peak PWC season.	Meets objective as in alternative A. In addition, expanded monitoring of resources would assist in recognizing a need for implementation of future restrictions.	Fully meets objective.
Socioeconomics				
National PWC ownership increased every year between 1991 and 1998; the rate of annual increase peaked in 1994 at 32% and dropped slightly in 1999, 2000, and 2001. Rentals of personal watercraft have also increased exponentially compared to other types of watercraft. Some businesses may be affected by actions to either increase or decrease PWC use.	Work cooperatively with concessioners and local businesses that rent or sell personal watercraft.	Fully meets objective. No local businesses rent or sell personal watercraft.	Fully meets objective. No local businesses rent or sell personal watercraft.	Does not meet objective because the decrease in visitation by PWC users and consequent costs of PWC use would result in slightly reduced visitor related revenues in the area.
Environmental Justice				
In some cases, PWC use may affect minority or low-income populations, for example, a small business in a very small low-income community that rents personal watercraft as its only source of income. If PWC use is prohibited in the national recreation area, PWC use would be displaced onto tribal waters.	Minimize potential impacts on minority and low-income populations.	Meets objective as no effects to minority or low-income populations would occur.	Meets objective as in alternative A.	Does not meet objective. PWC use would potentially become more concentrated on tribal waters and at tribal access points, increasing potential impacts to culturally and environmentally sensitive areas and increasing tribal enforcement needs and related costs.
National Recreation Area Management and Operations				
Some states and local governments have taken action, or are considering taking action, to limit, ban, or otherwise manage PWC use. While the park may be exempt from these local actions, consistency with state and local plans must be evaluated.	Seek cooperation with state entities that regulate PWC use.	Fully meets objective. No conflicts with other regulatory agencies.	Meets objective. No conflicts with other regulatory agencies.	Does not meet objective due to continued PWC use on adjacent tribal waters and difficulty of enforcement of the ban in NPS-managed waters.

Issue	Objective	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
PWC use may require additional park staff to enforce standards, limits, or closures because of increased accident rates and visitor conflicts. Enforcement capabilities are currently limited at Lake Roosevelt and enforcement of additional regulations may pose a challenge.	Minimize impacts to recreation area operations from increased enforcement needs.	Fully meets objective. Enforcement needs would not change.	Meets objective. No change in enforcement needs.	Does not meet objective. Enforcement of a PWC ban would require an increase in park staff in order to fulfill enforcement needs.

AFFECTED ENVIRONMENT

WATER QUALITY

PHYSICAL CHARACTERISTICS OF LAKE ROOSEVELT

The Grand Coulee Dam, located on the Columbia River in northwest Washington, forms Lake Roosevelt. Lake Roosevelt extends approximately 150 miles along the Columbia River, 130 miles of which is designated a national recreation area. The lake is up to 5 miles wide in several locations, but averages 0.5 miles wide or less. The majority of inflow to Lake Roosevelt comes from the Columbia River (89%), and the Spokane River (7%). The Colville, Kettle, and Sanpoil rivers contribute the remaining 4% of the flow. The lake provides more than 9 million acre-feet of storage at any one time to support various uses such as power generation, flood control, irrigation, domestic water supply, industry, recreation, and additional flows for anadromous fish passage in the lower Columbia River (NPS 1999).

The Grand Coulee Dam, located in the middle reaches of the Columbia River watershed, is the largest storage structure of the 30 dams on the Columbia River. Because of the large storage capacity available in Lake Roosevelt, the dam is important to the coordinated operation of all structures along the Columbia River. Retention time of water in the reservoir and drawdown elevation is controlled by several agencies including the Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (USACE), and the Bonneville Power Administration. The release of water from the reservoir increased dramatically in 1974, when additional power generating capacity was added. This increase in the release of water drastically reduced the retention time of water in the reservoir. Since 1991 retention times have increased slightly due to an increased awareness of their importance to reservoir ecology. More recent water retention times in Lake Roosevelt range from 8 to 65 days (Columbia Basin Fish and Wildlife Authority 2000). Water moves most rapidly through the reservoir system between March and June, and stays in the reservoir longest between September and January (NPS 1997b).

Because of the short retention time of water in the reservoir, Lake Roosevelt exhibits more riverine qualities than most reservoirs. There is a lack of temperature stratification in the lake resulting in uniform water temperatures throughout the water column (Columbia Basin Fish and Wildlife Authority 2000). The short water retention time of the water combined with the lack of temperature stratification results in a well-mixed volume of water within the reservoir. Light penetration into Lake Roosevelt is greatest at the dam and generally decreases upstream due to suspended sediment from the Columbia River. Water transparency is lowest in the summer when phytoplankton populations reduce light penetration (NPS 1997b).

The operation of Lake Roosevelt requires the water level elevation to vary within a normal operating range of 1,208 feet above mean sea level to 1,290 feet above mean sea level. Typical operation of Lake Roosevelt results in water levels between 1,260 feet to 1,290 feet during the winter months. In late winter or early spring the water levels are reduced to provide storage in order to lessen flooding potential on the river downstream of the Coulee Dam during spring runoff. The lake fills to its highest levels during June, with a summer operating ranging between 1,280 feet to 1,290 feet.

At maximum pool (elevation 1,290 feet), the surface area of Lake Roosevelt is approximately 82,000 acres and the volume is 9,107,419 acre-feet. The elevation at minimum pool is 1,208 feet, with a corresponding surface area of 45,508 acres and a volume of 3,921,967 acre-feet. The volume of water available within the operating range of the reservoir between elevation 1,208 feet and 1,290 feet is 5,185,452 acre-feet (Sprankle 2002).

WASHINGTON WATER QUALITY STANDARDS

Classification of Waters. According to the Washington Department of Ecology (WDOE) Water Quality Standards for Surface Waters of the State of Washington, the waters of Lake Roosevelt, extending from the Grand Coulee Dam to the Canadian border, are classified as AA (extraordinary) (WDOE 1997). Class AA waters receive the maximum protection level under state water quality regulations (Washington Administrative Code [WAC] 173, section 201A). Water quality of Class AA waters is expected to markedly and uniformly exceed the requirements for all, or substantially all, uses. Beneficial uses designated for Class AA waters include, but are not limited to the following:

- Water supply for domestic, industrial and agricultural uses;
- Stock watering;
- Fish and shellfish (including migration, rearing, spawning, and harvesting);
- Wildlife habitat;
- Recreation (primary contact recreation, sport fishing, boating and aesthetic enjoyment); and,
- Commerce and navigation.

Antidegradation Standards. Lake Roosevelt, because it is a national recreation area, is designated as outstanding resource waters, according to the antidegradation policy of the state of Washington (WAC 173-201A-070). The antidegradation policy is designed to protect water quality at existing levels and to prevent a deterioration of water quality. The following paragraphs from the antidegradation policy apply to Lake Roosevelt:

- Existing beneficial uses are to be maintained and protected and no further degradation that would interfere with existing beneficial uses is allowed. The beneficial uses identified for Lake Roosevelt are listed above.
- Water quality must be maintained and protected in waters designated as outstanding resource waters.

Numeric Standards. Water quality standards for Washington that address toxic substances are found in section WAC 173-201A-040 of the Washington Administrative Code (WDOE 1997). Gasoline-related organic compounds associated with the operation of watercraft are not specifically listed in this section. EPA human health based water quality criteria apply to compounds not specifically addressed in the state standards. These criteria are found in 40 CFR 131.36, Toxics criteria for those states not complying with Clean Water Act section 303(c)(2)(B), (EPA 2002c) and shown in table 6.

TABLE 6: WATER QUALITY STANDARDS FOR ORGANIC POLLUTANTS

	Human Health Criteria	
Compound	Water and Organisms (µg/L)	Organisms Only (µg/L)
Benzo(a)pyrene	0.0028	0.031
Benzene	1.2	71

Source: EPA 2002c.

WATER QUALITY DATA

The quality of water in Lake Roosevelt is generally good due to the low retention time of water in the lake, and the acceptable levels of contaminants in the water column (Serdar et al. 1994). During spring run-off, flows as high as 300,000 cubic feet per second can be released from Grand Coulee Dam, which results in high flushing. The entire portion of the reservoir where PWC use occurs is characterized by high flow. This prevents the accumulation of watercraft pollutants from occurring in any one area.

Lake Roosevelt is a repository for a wide range of organic and inorganic pollutants. The Columbia River drains a major sector of British Columbia's mining, smelting, and timber industries. Other tributaries entering the lake also drain a variety of landforms and land uses, including intensively used agricultural lands and commercial timberlands. The Spokane River serves the water supply needs of the city of Spokane, Washington and the cities of Post Falls and Coeur d'Alene, Idaho (NPS 1999).

Point-source industrial pollution is the primary concern for water quality of Lake Roosevelt. The two major sources of concern have been a lead/zinc smelter and a pulp mill in British Columbia. The presence of heavy metals such as zinc, cadmium, mercury, and lead in the water column and sediments has been primarily attributed to effluent and slag discharging and accidental spills into the Columbia River from these industrial sites. Recently, improvements have been made in the operation of both of these sources that have resulted in reduced pollutant concentrations in the water and suspended particles of Lake Roosevelt (NPS 1997a). As a result, concentrations of metals being discharged to the Columbia River have been declining. Monitoring is continuing to verify these improvements (NPS 1999).

Other sources that affect water quality at Lake Roosevelt include sewage treatment plants, runoff from nearby agricultural, logging, and mining areas, shoreline erosion and development, campsite sewage, and deposition from air pollution. Based on the minimal water quality monitoring data that is available, there is no evidence of emission-related or bacteriological contamination at Lake Roosevelt.

MOTORIZED WATERCRAFT AND WATER QUALITY

Motorized boating activity within Lake Roosevelt includes inboard/outboard ski boats, fishing boats, pleasure boats including house and pontoon boats, and personal watercraft. All of these watercraft contribute pollutants of concern to the waters of the reservoir. The quantity of pollutants contributed depends on the type and number of watercraft and the length of time they operate within the reservoir.

The primary pollutants of concern that may be emitted from marine engines include MTBE, PAH, BTEX, and heavy metals such as copper. MTBE is a gasoline additive that has been successful in reducing air pollution, however it has been controversial from a water quality perspective. Washington is in the process of phasing out the use of MTBE as an additive to gasoline, and a ban on its use will become effective December 31, 2003. Before the ban takes effect, MTBE may still be present at varying concentrations in gasoline available in Washington. MTBE in gasoline purchased in Washington may range from 0% to as much as 10% by volume. After December 31, 2003, MTBE may not be intentionally added to any gasoline, motor fuel or clean fuel produced for sale or use in the state of Washington and in no event may MTBE be present in gasoline above 0.6 of one percent by volume (U.S. Department of Energy 2002).

Some studies suggest that personal watercraft may disturb sediments on river or lake bottoms and cause turbidity. This may affect water quality in shallow water ecosystems for dependent small water organisms such as plankton.

AIR QUALITY

The WDOE is responsible for monitoring and evaluating air quality in the state. WDOE has adopted the federal national ambient air quality standards (NAAQS) except where noted in table 7 under the Washington standards. Current standards are set for sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter equal to or less than 10 microns in size (PM_{10}), fine particulate matter equal to or less than 2.5 microns in size ($PM_{2.5}$), and lead (Pb). These pollutants are collectively referred to as criteria pollutants.

The only WDOE air quality monitoring station near the park is a particulate monitor at the Stevens County courthouse in Colville, Washington. In the 1990s, the daily standard was exceeded once per year in 1996 through 1998. The annual PM_{10} standard was exceeded in 1996 and 1997. The station has been changed to monitor $PM_{2.5}$; thus recent data is not available. WDOE monitors CO, PM_{10}, and ozone in Spokane, approximately 60 miles away. EPA data from a report entitled *Peak Air Quality Statistics for the Six Principal Pollutants by County* (EPA 2000b) indicates that ambient air quality levels in Spokane and Stevens Counties are in the allowable range for the nation.

Areas are classified under the Federal *Clean Air Act* as either "attainment" or "nonattainment" areas for each criteria pollutant based on whether the NAAQS have been achieved attainment or nonattainment. When an area has been redesignated as an attainment area after having been nonattainment, it is also classified as a maintenance area. Washington has experienced a decline in air pollutants over the past 20 years, but has three areas of nonattainment. Ambient air quality standards that have been violated in Washington are CO and PM_{10} levels in the Spokane metropolitan area and the central business district of Yakima, as well as PM_{10} levels in Wallula (EPA 2002).

Ambient air pollutant concentrations for the recreation area are within national and state air quality standards. This attainment status may be attributed to the relatively low population density near Lake Roosevelt. Air-quality related values, scenic vistas, and pollution sensitive resources have not been identified for the recreation area.

Air particulates in the area are caused by dust from agricultural operations, unpaved roads, and dust storms when the reservoir is low. The predominant wind direction is from the south southeast (NPS 2000d). During the summer, prescribed burns and wildfires on forest land can cause temporary worsening of atmospheric and visibility conditions. Smelter plants, pulp, and paper mills in the area add sulfur dioxide, nitrous oxides, and particulates to the air; however, these emissions and air particulates do not violate the national ambient air quality standards. Air quality in the vicinity of reservoirs is adversely affected when high winds combine with exposed reservoir sediments to create dust storms of varying severity. The Environmental Protection Agency recently stated that airborne contaminants in the Lake Roosevelt area may be of concern to human health and has recommended additional studies (USGS 2001). At this time, no studies are available which determine if the PM_{10} standards are exceeded in these local areas (USACOE 2002).

The recreation area is designated a Class II Airshed. This designation was established by Congress to facilitate the implementation of air quality provisions of the *Clean Air Act*. This designation allows a moderate increase in certain air pollutants. The *Clean Air Act* requires that the National Park Service comply with all federal, state, and local air pollution control laws (section 118). Adjacent to the eastern boundary of Lake Roosevelt is the Spokane Indian Reservation, which is designated a Class I Airshed. Class I designation mandates the most protective requirements for protection of air quality related values (NPS 2000c).

TABLE 7: NATIONAL AND WASHINGTON AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	National Standard[a,b]		Washington Standard[b]	Purpose
		Primary[c, e]	Secondary[d, e]		
Carbon Monoxide (CO)	1-hour	35 ppm/ (40 mg/m^3)	—	35 ppm	Prevent high levels of carboxyhemoglobin
	8-hour	9 ppm (10 mg/m^3)	—	9 ppm	
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as primary	0.05 ppm	Prevent breathing difficulties, reduce smog and acid rain formation, and improve visibility
Particulate Matter (PM_{10})	24-hour	150 µg/m^3	Same as primary	150 µg/m^3	Prevent chronic diseases of the respiratory tract and improve visibility
	Annual Arithmetic Mean	50 µg/ m^3	Same as primary	50 µg/m^3	
Fine Particulate Matter ($PM_{2.5}$)[f]	24-hour	65 µg/ m^3	Same as primary	No standard	Prevent chronic diseases of the respiratory tract and improve visibility
	Annual Arithmetic Mean	15 µg/ m^3	Same as primary	No standard	
Ozone (O_3)[f]	1-hour[g]	0.12 ppm (235 µg/ m^3)	Same as primary	0.12 ppm	Prevent breathing difficulties, eye irritation, and biological effect on sensitive species
	8-hour	0.08 ppm (157 µg/ m^3)	Same as primary	No standard	
Sulfur Dioxide (SO_2)	3-hour	—	0.50 ppm (1300 µg/ m^3)	—	Prevent increased respiratory damage, acid rain, and crop damage and to improve visibility
	24-hour	0.14 ppm (365 µg/ m^3)	—	0.10 ppm	
	Annual Arithmetic Mean	0.03 ppm (80 µg/ m^3)	—	0.02 ppm	
	1-hour	—	—	0.40 ppm[h]	
Lead (Pb)	Quarterly Average	1.5 µg/ m^3	Same as primary		Prevent impaired production of hemoglobin
Total Suspended Particulate	24-hour	—	—	150 µg/m^3	Prevent chronic diseases of the respiratory tract
	Annual Geometric Mean	—	—	60 µg/ m^3	

Source: (EPA 2003, WDOE 2000)

µg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; ppm = parts per million; dash (-) indicates no standard

a. National Ambient Air Quality Standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year.

b. Annual standards never to be exceeded; short-term standards not to be exceeded more than once per year unless noted.

c. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

d. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

e. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 millimeters (mm) of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibar). Ppm in this table refers to ppm by volume or micromoles of pollutant per mole of gas.

f. New federal 8-hour ozone and fine particulate matter standards were promulgated by the Environmental Protection Agency on July 18, 1997. The federal 1-hour O_3 standard continues to apply in areas that violated the standard. Contact the Environmental Agency for further clarification and current federal policies. (The federal standards for 8-hour ozone and $PM_{2.5}$ became effective on September 15, 1997, and were subsequently challenged and litigated. The U.S. Supreme Court affirmed the standards, and policies and systems to implement these new standards are being developed. No attainment classifications have been made for these pollutants. No new controls with respect to the new standards have been promulgated.)

g. Not to be exceeded on more than 1.0 days per calendar year as determined under the conditions indicated in chapter 173-475 of the WAC.

h. 0.25 not to be exceeded more than two times in any 7 consecutive days.

The SUM06 index is used to evaluate potential O_3 impacts to vegetation. SUM06 is a value of the cumulation of instances when measured hourly average ozone concentrations equal or exceed 0.06 part per million (ppm) in a stated time period, expressed in ppm-hours. Data compiled by the NPS Air Resources Division show the SUM06 ozone index in the Lake Roosevelt area at 0–6 ppm-hours.

SOUNDSCAPES

Soundscapes include both natural and human components. Natural soundscapes include all naturally occurring sounds such as waves on the shoreline, running water, birds calling, wind blowing through trees, or the sound of thunder. Soundscapes also includes "natural quiet" that occurs in the absence of natural or human-caused sound. The opportunity to experience natural sounds is an enjoyable part of some visitors experience at the recreation area.

Human-caused sounds at Lake Roosevelt include all types of watercraft (including personal watercraft), vehicles from State Route 25 and U.S. 395, aircraft, lumber operations, and electronic devices such as boom boxes and horns. While most human noise sources occur in isolated areas, aircraft can be heard throughout the park. Navy jet aircraft, which are unaffected by park zoning, fly over the park once a day during summer months and are often the only mechanized noise source in the more remote areas of the recreation area.

Human sounds are not unexpected or inappropriate at the recreation area, but are a part of the overall soundscape in an area where water activities, picnicking, camping and other recreation use are part of the purpose of the park. Evaluation of the appropriateness of human sounds is evaluated by considering visitor expectation, management guidelines, resource sensitivity and park purpose.

NATURAL AND HUMAN NOISE LEVELS

Noise is generally defined as an unwanted or intrusive sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them. Sound is measured in a logarithmic unit called a decibel (dB). Since the human ear is more sensitive to middle and high frequency sounds than to low frequency sounds, sound levels are weighted to reflect human perceptions more closely. These "A-weighted" sounds are measured using the decibel unit dBA. Table 8 illustrates common sounds and the measured sound level.

For the average human a 10 dBA increase in the measured sound level is subjectively perceived as being twice as loud, and a 10 dBA decrease is perceived as half as loud. The decibel change at which the average human would indicate that the sound is just perceptibly louder or perceptibly quieter is 3 dBA. There is generally a 6 dBA reduction in sound level for each doubling of distance from a noise source due to spherical spreading loss (e.g., if the sound level at 25 feet from a personal watercraft was 86 dBA, the sound level at 50 feet would be expected to be 80 dBA, at 100 feet 74 dBA).

Personal watercraft and outboard motors are similar in the noise they generate. The National Park Service contracted for noise measurements of personal watercraft and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris Miller Miller & Hanson, Inc. 2002). The results show that maximum PWC noise levels at 25 meters (82 feet) ranged between 68 to 76 dBA. Noise levels for other motorboat types of similar horsepower as the personal watercraft measured during that study ranged from 65 to 77 dBA at 25 meters (82 feet). The larger boats, characterized as "V8 'muscle' boats," had noise levels of 85 to 86 dBA at 25 meters (82 feet). However, unlike motorboats, personal watercraft are highly maneuverable and are used for stunts and acrobatics, often resulting in quickly varying noise levels due to

TABLE 8: SOUND LEVEL COMPARISON CHART

Decibels (dBA)	How it Feels	Equivalent Sounds
140–160	Near permanent damage level from short exposure	Large caliber rifles (e.g., .243, 30-06)
130–140	Pain to ears	.22 caliber weapon
100	Very loud Conversation stops	Air compressor at 20 feet; garbage trucks and city buses; power lawnmower; diesel truck at 25 feet
90	Intolerable for phone use	Steady flow of freeway traffic; 10 hp outboard motor; garbage disposal
80		Muffled jet ski at 50 feet; automatic dishwasher; near drilling rig; vacuum cleaner
70		Drilling rig at 200 feet; window air conditioner outside at 2 feet
60	Quiet	Window air conditioner in room; normal conversation
50	Sleep interference	Quiet home in evening; drilling at 800 feet; bird calls
40		Library
30		Soft whisper
20		In a quiet house at midnight; leaves rustling

Note: Modified from Final Environmental Impact Statement, Miccosukee 3-1 Exploratory Well, Broward County, Florida (U.S. Department of the Interior n.d.).

changes in acceleration and exposure of the jet exhaust when crossing waves. The frequent change in pitch and noise levels, especially if operated closer to land, make the noise from personal watercraft more noticeable to human ears (Asplund 2001).

Boat use is not uniform over the 81,389 acres of Lake Roosevelt. Boat use, including PWC use, tends to concentrate in the southern end of the lake, including Porcupine Bay and Two Rivers, due to their proximity to Spokane. However, noise sensitive areas such as campgrounds and waterfront hiking trails are dispersed throughout the park. Noise sensitive activities that may occur throughout the lake and immediate area include boat and shoreline fishing, and wildlife watching.

During high-use periods, the sound of boats can be continuous in popular parts of the recreation area. Boat noise is noticeable in the natural zone areas near the lake during periods of high boating activity, but there are extended periods when boating noise is not noticeable. Currently, Kettle River above the Napoleon Bridge and Hawk Creek are the two areas designated as flat-wake zones, and Crescent Bay Lake is the only area within the recreation area where motorized boating is prohibited. There are no existing areas on the main body of the lake where visitors can go to be sure of escaping boating-related sounds.

When in use, personal watercraft make up about 4% of the vessels on the water at Lake Roosevelt. The primary season for PWC use is June through September, with highest use in July and August. From December through March, PWC use is negligible due to cold weather and water temperatures. Noise related to personal watercraft and other vessels, and sounds related to other human activity, are typically highest during the summer months, especially at Two Rivers and Porcupine Bay, where most PWC launch.

VISITOR RESPONSES TO PWC NOISE

Many factors affect how an individual responds to noise. Primary acoustical factors include the sound level, its frequency, timing, and duration. Secondary acoustical factors include the spectral complexity,

sound level fluctuations, frequency fluctuation, rise-time of the noise, and localization of the noise source (Mestre Greve Associates 1992).

Non-acoustical factors also play a role in how an individual responds to sounds. These factors vary from the past experience and adaptability of an individual to the predictability of when a noise will occur. The listener's activity also affects how he/she responds to noise. For example, for users of personal watercraft who are picnicking near the water edge and can hear the sounds of personal watercraft, the sound may not be bothersome, but non-PWC users in the same location may be annoyed by the sound.

Personal watercraft generate noise that varies in pitch and frequency due to the nature of their construction and use. The two-stroke engines are often used at high speeds, and the craft bounce along the top of the water such that the motor discharges noise below and above the water surface. To recreation area visitors this irregular noise may seem to be more annoying that that of a standard motorboat that is cruising along the shoreline, even though the maximum noise levels may be similar for the two watercraft (approximately 80 to 90 dBA at 50 feet). Additionally, visitors who expect to experience natural quiet may consider the irregular noise of personal watercraft more annoying, especially if the craft is operating in one location for extended periods of time. There have been complaints at Lake Roosevelt about watercraft noise. The majority of complaints have been about the high-powered "cigarette boats," with infrequent complaints about PWC noise.

The opportunity to experience the natural soundscape is part of the visitor experience. The park's natural soundscape contributes to a positive visitor experience and is a direct or indirect component of why many people visit the national recreation area.

WILDLIFE AND WILDLIFE HABITAT

GENERAL WILDLIFE HABITAT AND VEGETATION DESCRIPTION

Lake Roosevelt National Recreation Area is located within a semi-arid transition zone characterized by steppe and shrub steppe communities in the southern lower elevation areas, pine savannahs in middle elevation areas, and forested communities in the northern, higher elevation portions. This transition of vegetation communities provides habitat for a wide range of wildlife species.

The lower lake valley between the Grand Coulee Dam and Keller Ferry is primarily composed of disturbed sage-steppe and irrigated agricultural lands. Vegetation communities in this southern portion of the recreation area are dominated by shrubs such as antelope bitterbrush, rabbitbrush, and big sagebrush, with understories of bunchgrasses such as bluebunch wheatgrass, needle-and-thread grass, and Idaho fescue. Other species interspersed throughout the area include arrowleaf balsamroot, northern buckwheat, brittle prickly pear, alumroot, and lupine.

The middle portion of the reservoir from Keller Ferry to the upper end of the Spokane River Arm gradually transitions from shrub steppe to ponderosa pine and Douglas fir forest. Grasses and shrub species mentioned above are common in this zone along with snowberry, greasewood, and serviceberry. Riparian areas along tributaries within this zone are characterized by dogwood, willows, river birch, and black cottonwood.

Dense ponderosa pine forests, Douglas fir, and grasslands are found along the middle and upper lake, between the Spokane River and Kettle Falls. Steppe communities are less common than in the lower-middle sections. Grasses include those mentioned above with the addition of pinegrass in the ponderosa pine understory. Alder, willow, hazelnut, and black cottonwood are common along the waterways, and

some Rocky Mountain juniper may be found on rocky river bars or along the shoreline. Forbs include hairy goldstar, phlox, and nodding onion. Shrubs include chokecherry, serviceberry, wild rose, Douglas hawthorn, snowberry, and occasionally smooth sumac and blue elderberry.

Forests dominated by second-growth ponderosa pine, Douglas fir, and western larch dominate near the park boundary in the upper valley, north of Kettle Falls to Onion Creek. Aspen and western paper birch are also found in these areas. Shrubs found among the pines include mallow ninebarks, Oregon grape, elderberry, chokecherry, snowberry, deer brush, and red-stem ceanothus. Grasses include bluebunch wheatgrass, Idaho fescue, and pinegrass.

The above vegetation communities provide habitat for abundant and varied wildlife, including over 75 species of mammals, 200 species of birds, 15 species of reptiles, and 10 species of amphibians. Complete inventories of wildlife present in the recreation area are lacking (NPS 2000c).

Terrestrial habitat for wildlife is limited by the linear nature of the recreation area. The areas with greatest wildlife habitat value include natural areas of ponderosa pine forests, sagebrush, grasslands with water resources, and tributary riparian areas. Inundation of the bottomland from filling of the reservoir caused a loss of range for animals in the area. Even so, portions of the recreation area are considered important winter range for white-tailed and mule deer. In addition, large ponderosa pine trees and snags provide roosting and nesting habitat for bald eagle, a threatened species (NPS 2000c, 2000e).

MAMMALS

Common large mammal species include white-tailed and mule deer, coyote, bobcat, and black bear. Elk, moose, and mountain lion are less common. These species tend to move through the area in response to daily and seasonal migrations. Common small mammals include badger, beaver, river otter, muskrat, mink, raccoon, skunk, bobcat, red fox, porcupine, cottontail rabbits, ground squirrels, chipmunks, yellowbelly marmot, pika, shrew, voles, bats, gophers, rats, deer mice, and house mice.

The habitats of the majority of mammals are located away from the shoreline, and animals move further inland if disturbed by visitor activities while at the shoreline.

BIRDS

Due to the rich diversity of habitats within the Lake Roosevelt National Recreation Area, an abundance of bird species are present. The lake is within the Pacific Flyway and serves as a resting area during migration periods. Many bird species are attracted by the abundance of water and small areas of wetland and riparian habitats such as those found in adjacent tributaries. Resident and migratory birds common to the area include waterfowl, shorebirds, gallinaceous birds, pigeons, woodpeckers, hummingbirds, raptors, and passerines.

Common migrating waterbirds include surface feeding ducks such as mallards, pintails, teal, and golden eyes, diving ducks such as redheads, coots and buffleheads, western grebe, coot, lesser scaup, common merganser, common loon, and Canada goose. Occasional use by tundra and trumpeter swans is also known to occur. Sandpipers, northern killdeer, great blue heron, gulls, snipe, kingfisher, curlews, and yellowlegs are common wading and shorebirds of the area.

Upland game species include native species such as western sage grouse, Columbia sharp-tailed grouse, mourning dove, blue grouse, and the band-tailed pigeon. Introduced game species include the ring-necked

pheasant, chukar, Hungarian partridge, and California quail. Agricultural practices and elimination of fencerows (strips of threes along edges of fields) have reduced habitat for native and introduced species.

Raptors that use the general area for nesting, roosting, or foraging include osprey, golden eagle, bald eagle, prairie falcon, red-tailed hawk, northern harrier, and American kestrel. Peregrine falcons migrate through the recreation area seasonally. Owls that occur throughout the area include the snowy owl, great-horned owl, saw-whet owl, screech owl, and barn owl. Nesting habitat for owls and raptors primarily consists of forested areas along the northern portions of the recreation area.

Common passerines that use the area for foraging and nesting include swallows, finches, jays, chickadees, kinglets, ravens, magpies, robins, sparrows, blackbirds, and juncos.

Of the birds present in the national recreation area, waterfowl are the most likely to be affected by watercraft activities. The majority of suitable waterfowl habitat is located in the mouths and upper portions of tributaries such as Hawk Creek and the Kettle and Colville Rivers (Riedel 1997). These areas are currently protected by flat-wake restrictions applicable to all motorized watercraft.

FISH

Fish populations in Lake Roosevelt have changed dramatically since the early 1900s. The most significant change resulted from the inundation of the reservoir itself. Prior to that event, the upper Columbia River supported a fish assemblage that was dominated by 11 anadromous salmonid stocks. Today, there are no anadromous runs of salmonids from the Pacific in Lake Roosevelt or its tributaries. Other factors influencing fish populations in Lake Roosevelt include introduction of non-native species, habitat alterations such as water pollution, and reservoir drawdowns. A possible 28 native species and 12 non-native species inhabit the waters of the recreation area (NPS 1999).

Native salmonids that continue to survive in the waters of Lake Roosevelt include kokanee (land-locked sockeye) and rainbow trout. Other native fish include white sturgeon, burbot, and a variety of whitefish, minnow, sculpin, and sucker species. Native bull trout and sturgeon populations have declined dramatically over the last 10 years due to competition with introduced species (NPS 1999).

Introduced game fish in Lake Roosevelt include brook trout, brown trout, walleye, yellow perch, largemouth bass, small mouth bass, black crappie, white crappie, sunfish, and yellow bullhead. These species are considered important game species. Carp and golden tench have also been introduced, but are considered to be nuisance species (NPS 1999).

AMPHIBIANS AND REPTILES

Little is known about the occurrence, abundance, distribution or critical habitat of reptile and amphibian species within the national recreation area. A systematic inventory has not been conducted. Reptile and amphibian species known to occur in the recreation area include the sagebrush lizard, short-horned lizard, western rattlesnake, bull (or gopher) snake, western terrestrial garter snake, bullfrog, western toad, Great Basin spade-foot toad, western tree frog, and various salamanders.

AQUATIC INVERTEBRATES

The recreation area has not been surveyed for aquatic invertebrates. Generally, the abundance and type of organisms present depend on the water quality and habitat conditions within a water body. Habitat for aquatic invertebrates includes areas of dense aquatic vegetation. The shoreline of Lake Roosevelt has few areas with significant aquatic vegetation; thus, the diversity and abundance of invertebrates along the shoreline is expected to be low, with most organisms associated with creek mouths and wetlands.

THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

WILDLIFE SPECIES

The U.S. Fish and Wildlife Service lists certain species as threatened or endangered when they are deemed to meet criteria under the *Endangered Species Act of 1973*. In addition, candidate species are designated when there is adequate information regarding threats or vulnerability to warrant issuance of proposed rule to list, but circumstances preclude rule issuance. Species of concern are those species for which listing may be warranted, but further research and study are needed. The State of Washington follows a similar system to designate certain species inhabiting the state with special status.

Wildlife species listed by the U.S. Fish and Wildlife Service or by the Washington Department of Fish and Wildlife as threatened or endangered that may occur in or near the Lake Roosevelt National Recreation Area are listed in table 9.

FEDERAL SPECIES

The bald eagle is the only federal listed threatened or endangered species to have documented resident populations within the Lake Roosevelt National Recreation Area. Bald eagle populations within the recreation area vary between a low resident population in the summer and a larger over-wintering population of more than 200 individuals (NPS 2000c). In the summer of 2000, nine nesting territories were identified within the national recreation area, seven of which were occupied (*Annual Performance Plan for Fiscal Year 2002* [NPS 2001a]). A report on bald eagle nest production from 1987–2000 states that, at that time, there were 24 bald eagle territories in the Lake Roosevelt vicinity (Murphy 2000 – sensitive data). Of these, a maximum of 21 had been occupied in any one year. Over the 2002 winter season, three mid-winter surveys were conducted that yielded an average of approximately 210 bald eagles (Hebner 2002). PWC use occurs during the summer months when over-wintering eagle populations are not present. Total numbers of resident eagles were found to be on an upward trend from the years 1987 to 2000.

Lake Roosevelt is considered potential habitat for bull trout, but the regular occurrence of the species within the reservoir is not likely, as inundation of the reservoir drastically changed habitat conditions. Bull trout sampling efforts on Lake Roosevelt have been ongoing since 1985. During this time period, seven bull trout were sampled, all from tributaries to the Columbia River, Lake Roosevelt, or the Kettle River. One bull trout was found on the Spokane Arm of Lake Roosevelt, but near spring inflow areas. It is believed that the sampled fish are likely to be from up-river stocks and are not native to the area. (Spokane Tribe of Indians 2002). Bull trout spawn in small tributary streams and construction of dams often blocks migratory routes and disconnects spawning and nursery areas. Additional threats include increased siltation and competition with or predation by other fish species.

TABLE 9: FEDERAL AND STATE LISTED WILDLIFE IDENTIFIED IN THE VICINITY OF LAKE ROOSEVELT NATIONAL RECREATION AREA

Common Name	Scientific Name	Federal Status	State Status	Habitat Present at Shoreline
Birds				
Bald eagle	*Haleaeetus leucocephalus*	T	T	X
Loggerhead shrike	*Lanius ludovicianus*	SC	C	
Northern goshawk	*Accipiter gentiles*	SC	C	
Burrowing owl	*Athene cunicularia hypugnea*	SC	C	
Ferruginous hawk	*Buteo regalis*	SC	T	
Peregrine falcon	*Falco peregrinus*	SC	S	X
Black tern	*Chlidonias niger*	SC	M	X
American white pelican	*Pelecanus erythrorhynchos*		E	X
Columbia sharp-tailed grouse	*Tympanuchus phasianellus columbians)*	SC	T	
Mammals				
Canada lynx	*Lynx canadensis*	T	T	
Gray wolf	*Canis lupus*	E	E	
Woodland caribou	*Rangifer tarandus caribou*	E	E	
Grizzly bear	*Ursus arctos horribilis*	T	E	
California bighorn sheep	*Ovis canadensis canadensis*	SC		X
Washington ground squirrel	*Spermophilus washingtoni*	C	C	
Potholes meadow vole	*Microtus pennsylvanicus kincaidi*	SC	M	
Pallid Townsend's big-eared bat	*Coryhorhinus townsendii pallescens*	SC	C	
California wolverine	*Gulo gulo luteus*	SC	C	
Pacific fisher	*Martes pennanti pacifica*	SC	E	
Moose	*Alces alces*		C	
Myotis bats	*Myotis spp. (4 species)*		M	
Fish				
Bull trout	*Salvelinus confluentus*	T	C	
Mollusks				
California floater	*Anodonta californiensis*	SC	C	
Amphibians				
Columbia spotted frog	*Rana luteiventris*	SC	C	

Source: U.S. Fish and Wildlife Service, Aug. 24, 2001; Washington Department of Fish and Wildlife, June, 2002; U.S. Fish and Wildlife Service, 2002.

E = Endangered Species; T = Threatened Species; C = Candidate Species; SC = Species of Concern; M = Monitor Species; S = Sensitive Species

Canada lynx are not believed to reside in the immediate area, but at least one sighting has been recorded near the northern end of Lake Roosevelt (NPS 2000c, Pacific Biodiversity Institute 2002). Primary habitat for the species is located in higher elevation forested areas away from the recreation area. Other federal listed species, such as the gray wolf, woodland caribou, and grizzly bear are not known to occur within the national recreation area, although potential habitat exists in areas near the recreation area.

Additional special status species in the area include federal candidate or species of concern such as the California bighorn sheep, Washington ground squirrel (candidate), potholes meadow vole, pallid Townsend's big-eared bat, California wolverine, Pacific fisher, California floater, and Columbia spotted frog. Of these, the only species known to occur within the shoreline area near PWC use is the California

bighorn sheep. Bighorn sheep were reintroduced to the area in the late 1980s and populations have since grown (Spokane Tribe of Indians 2000). Individuals are occasionally seen in the Lincoln area of Lake Roosevelt.

Avian federal species of concern include the loggerhead shrike, northern goshawk, burrowing owl, ferruginous hawk, American peregrine falcon, and black tern. Limited information is available regarding the shrike, goshawk and owl; however, they are not believed to occur in the immediate vicinity of Lake Roosevelt. The ferruginous hawk may occur in or nearby the recreation area but is not known to breed in the analysis area.

There are ongoing efforts to reestablish a breeding population of peregrine falcons to the recreation area. Currently there is no known peregrine nesting activity within the recreation area (NPS 2000d, NPS 2001c). However, peregrines frequent the area during spring and fall migrations when PWC use is low or absent in Lake Roosevelt.

Habitat areas for the black tern are located along drainages in northeast Washington, including the Columbia River and Lake Roosevelt (Washington Department of Wildlife 1999). Black tern nesting habitat consists of wetlands in shallow freshwater locations with significant emergent vegetation (Montana Partners in Flight n.d.). At Lake Roosevelt this habitat is limited to portions of inflow drainages that support wetland vegetation. Some of these areas are not accessible to motorized watercraft. In the areas that are accessible, flat-wake restrictions are currently in place to regulate personal watercraft and other boat operations.

STATE SPECIES

The federal listed species are also given special status designation by the State of Washington Department of Fish and Wildlife in addition to their federal status. In addition, the American white pelican is listed as endangered by the state, and moose are a state candidate species. Both of these species may occasionally visit the shoreline of Lake Roosevelt, but neither is a resident. Both are more likely to occur in side drainages with lush vegetation and are not likely to occur in areas of high PWC use. Four species of myotis bats are designated state monitor species due to a need for further field investigations and data gathering. Detailed information regarding populations of these species in and around Lake Roosevelt National Recreation Area is limited, and they are not known to occur within the immediate study area.

The Columbia sharp-tailed grouse is a state threatened species that has undergone a significant reduction in habitat due to agricultural practices, livestock grazing, and development. Habitat for the grouse includes sagebrush grasslands or mountain shrub communities. Columbia sharp-tailed grouse are known to occur on tribal lands, but no surveys have been conducted within the recreation area. According to Washington Gap Analysis data, habitat for Columbia sharp-tailed grouse is not present at Lake Roosevelt (Washington Department of Wildlife 1999).

PLANT SPECIES

Lake Roosevelt National Recreation Area contains potential habitat for one federal listed plant, the Ute ladies'-tresses. Although Ute ladies'-tresses could potentially occur in the recreation area, no populations are currently known to exist within the park. Thorough surveys by qualified individuals have not been completed to inventory this or other rare plant species within the recreation area. If the Ute ladies'-tresses is present, it would likely be in wetland areas associated with side drainages and not accessible to PWC use.

In addition, the Washington Natural Heritage Program maintains a list of special status plant species for the state. Table 10 displays those that are known to occur in the vicinity of the recreation area. No known populations of these species occur along the shoreline or within areas accessible by personal watercraft, although potential habitat exists along or near the shoreline for Columbia crazyweed, giant helleborine, least bladdery milkvetch, and Nuttall's pussytoes.

Historic populations of Columbia crazyweed occurred along the Columbia River above the mouth of the Spokane River. However, these populations were extirpated during construction of the Grand Coulee Dam. It is unlikely that any plants persist in the area (WNHP 2002).

The least bladdery milkvetch and Nuttall's pussytoes both occur in habitat like that surrounding Lake Roosevelt, but both occur at elevations of at least 1,400 feet. The shoreline elevation of Lake Roosevelt at full pool is 1,290 feet. Therefore, any populations within the recreation area would be located in upland areas at least 100 feet from the shoreline (WNHP 2002).

The giant helleborine is a wetland orchid species. If populations exist along the shoreline of Lake Roosevelt, they would be limited to portions of side drainages like Hawk Creek or the Kettle River that support wetland vegetation (WNHP 2002).

The remainder of the species listed in table 10 are not likely to occur within an area accessible to personal watercraft.

TABLE 10: PLANT SPECIES OF CONCERN AT LAKE ROOSEVELT NATIONAL RECREATION AREA

Common Name	Scientific Name	Federal Status	State Status	Habitat Present along the Shoreline
Ute ladies'-tresses	*Spiranthes diluvialis*	T	E	
Columbia crazyweed	*Oxytropis campestris* var. *columbiana*		T	X
Least bladdery milkvetch	*Astragalus microcystis*		S	X
Nuttall's pussytoes	*Antennaria parvifolia*		S	X
Giant helleborine	*Epipactis gigantea*		S	X
Crenulate moonwort	*Botrychium crenulatum*	SC	S	
Triangle-lobed moonwort	*Botrychium ascendens*	SC	S	
Two-spiked moonwort	*Botrychium paradoxum*	SC	S	
Cusik's lupine	*Lupinus cusickii*	SC	R1	
Washington polemonium	*Polemonium pectinatum*	SC	T	
Spalding's silene	*Silene spaldingii*	SC	T	
Black snake root	*Sanicula marilandica*		S	
Little grape-fern	*Botrychium simplex*		S	
Palouse's milkvetch	*Astragalus arrectus*		S	

E = endangered; T = threatened; SC = special concern, S = sensitive, R1 = more field study needed.

SHORELINE VEGETATION AND WETLANDS

Extensive shoreline vegetation is lacking at Lake Roosevelt due to steep banks and frequent water level fluctuations. Below the maximum pool level of 1,290 feet, there is mostly sand with very little vegetation of any kind. Portions of the reservoir that do have dense shoreline vegetation are primarily associated with tributaries such as the Colville River (Colville Flats), Hawk Creek, and the Kettle River.

Vegetation communities at the mouths of the Colville and Kettle Rivers are dominated primarily by canary reed grass and are considered intermittent wetlands characterized by seasonal flooding. These are the two largest wetland communities within the national recreation area. The upper Kettle River supports some scattered riparian and more diverse wetland communities with cottonwood, willow, cattail, and sedge species. Additional wetland communities are located at the Mill Creek inlet on the Spokane River, along the south shore bluff west of Lincoln Mill, and on the west shore immediately below the Little Dalles. The portions of Lake Roosevelt that support wetland communities are generally not conducive to PWC use due to shallow water and dense vegetation. In addition, the Hawk Creek and upper Kettle River wetland areas are designated as flat-wake zones, and thus are protected from excessive motorized vessel use.

Many exotic noxious plant species have been introduced to the recreation area. In general, these plants are non-desirable, non-native, invasive and aggressive species. An example is Eurasian milfoil, a non-native aquatic weed that can cause problems for swimming and boating as well as fisheries (Riedel 1997). Control of milfoil and other noxious weed populations is a part of the park operations that is limited due to funding.

VISITOR USE AND EXPERIENCE

Lake Roosevelt National Recreation Area is in a remote area of northeastern Washington. The nearest sizeable cities from park headquarters in Grand Coulee are Spokane, Washington (90 miles, population 200,000), Lewiston, Idaho (188 miles, population 30,000), Yakima, Washington (153 miles, population 222,000). The nearest large metropolitan areas are Seattle, Washington (230 miles, population 2.4 million), Portland, Oregon (337 miles, population 1.2 million) and Vancouver, B.C. (324 miles, population 1.8 million).

ANNUAL VISITOR USE

An average of approximately 1.4 million people visit Lake Roosevelt National Recreation Area each year. Nearly 90% of all visitors are considered regional, visiting from the Pacific Northwest. The remainder are destination visitors from other areas of the country, and "through" visitors traveling in Washington and stopping at Lake Roosevelt along the way. Except for visitors stopping to use camping facilities while traveling, most people come to Lake Roosevelt because of the water recreation opportunities at the reservoir.

VISITOR DISTRIBUTION

Visitor data for 1991 to 2001 indicate that visitation varies year to year (see table 11). Annual visitor numbers first reached over one million in 1987, fell to a low of 1,045,000 in 1996 and reached a high of 1,771,000 in 1991. In 1990 visitation increased by 41%; in 1992 visitation decreased by 37%; and in 1997 numbers increased again by 37%. Monthly visitor use is documented from 1979 through 2001. While the

TABLE 11: AVERAGE ANNUAL VISITATION AT LAKE ROOSEVELT NATIONAL RECREATION AREA, 1987–2001

Year	Number of Recreation Visitors	Percentage Change from Previous Year
1987	1,067,001	—
1988	1,366,305	2.8
1989	1,097,136	-1.9
1990	1,542,515	4
1991	1,771,420	1.0
1992	1,121,793	-37
1993	1,198,605	6.8
1994	1,515,674	26
1995	1,341,016	-12
1996	1,045,455	-22
1997	1,431,960	37
1998	1,545,150	7.9
1999	1,403,793	-9.1
2000	1,415,627	.8
2001	1,252,160	-11
Average	**1,367,513**	

national recreation area is open year-round, the highest visitor use occurs between June and September (nearly 75% of annual recreation visits), with the months of July and August generally showing the highest visitation (approximately 40% of visits). December and January generally have the lowest visitation with an average since 1997 of 31,000 per month. July and August have averaged 340,000 monthly during the same years. Based on staff observations, the typical annual peak use day is Fourth of July, unless it is a cool, rainy day, then the peak use day is July 15. This use pattern reflects the summer vacation season and is to be expected at a water-based park where nearly all recreational use is focused on the use of water in some way (NPS 2000c, NPS 2002e).

The population of the six-county area surrounding Lake Roosevelt National Recreation Area is increasing at a slightly higher rate than Washington state as a whole, which has a growth rate higher than the national growth rate (NPS 2000c). An increase in regional population could result in an increase in visitor numbers over the next 10 to 15 years.

In 1997, the North District (the part of the recreation area north of the Spokane Reservation) received about 48% of the recorded recreation use and the South District (that part of the recreation area south of the Spokane Reservation) received about 52% of the recreation visits. At individual sites, however, recreation use was unevenly distributed. For example, in 1997 the Kettle Falls camp area accounted for more than 21% (more than 300,000) of the total recreation area visitation (NPS 2000c). This level far exceeds use at any other location in the recreation area. The next most visited site in the North District was Hunters camping area, which accounted for 5.4% of total recreation area visits. All other areas in the North District that reported visitor use received between 0% and 3% of the total NRA visits (NPS 2000c).

In the South District of the recreation area, visitor use is more evenly spread among several sites. In 1997, six locations each accounted for between 4% and 8% of total recreation area visits, with four sites receiving more than 100,000 recreation visits each. The most popular recreation area-wide sites are the

Fort Spokane visitor center, the Fort Spokane camping area, Spring Canyon camping area, and Seven Bays Marina.

VISITOR USE PROFILE

In 1996 a visitor use study was conducted at the recreation area by the National Park Service (NPS 2000c). Data collected from 3,869 visitors indicated that most respondents (62%) were between 15 and 44 years of age, and 74% were from Washington. About 13% were from Canada and 5% from the Pacific Northwest. About 46% of respondents were repeat visitors. The most popular activities with the survey respondents were camping in a developed campground (16%), swimming (15%), motor boating (11%), and fishing (10%).

VISITOR ACTIVITIES

Lake Roosevelt, at approximately 150 miles long, is the largest single geographic feature in the northeastern corner of Washington, and is one of the major focal points of recreation in a region that has an abundance of recreational opportunities. The National Park Service manages approximately 60% of the reservoir's water surface, and the Colville Confederated Tribes and the Spokane Tribe manage the other 40%. The portion of the reservoir managed by the National Park Service includes about 312 miles of shoreline, 47,438 acres of water surface (at full pool), and 12,936 acres of land. Within approximately 100 miles of the Grand Coulee Dam, there are four national forests, six other major lakes or reservoirs, several smaller reservoirs on the Columbia and Snake Rivers, North Cascades National Park and Lake Chelan National Recreational Area. The Grand Coulee Dam itself is a tourist destination that attracts more than 400,000 visitors per year (NPS 2000c).

Approximately 70% of the visitors to Lake Roosevelt National Recreation Area participate in camping and fishing opportunities. These and other day use recreational opportunities are primarily located in 28 developed areas that are easily reached via numerous access points, which results in a widely dispersed visitation pattern throughout the recreation area (NPS 2001b). Despite the diversity of sites, visitor use tends to concentrate at the Spring Canyon, Fort Spokane, and Kettle Falls areas. Visitors engage in camping, swimming, sightseeing, photography, wildlife watching, fishing, waterskiing, and boating. Water-related activities include the use of speedboats, personal watercraft, canoes, sailboats, sailboards, and kayaks. Because PWC use may affect these and other visitor activities, they are discussed below.

Public use data is recorded throughout the park using patrol logs maintained by one of the protection districts. During the peak season, data is recorded on a daily log maintained by each district ranger, while during the off season, patrols are less frequent.

Camping

Over half of the 1.4 million visitors to Lake Roosevelt National Recreation Area list camping as the reason for their visit (NPS 2000c). To serve this demand, the National Park Service maintains 17 campgrounds accessible by land, 13 of which have boat launch facilities. Many boaters also camp in the 10 developed, boat-accessible campsites, or along the undeveloped shoreline. The Spokane Tribe maintains 11 additional campgrounds around the lake and the Colville Confederated Tribes maintain seven.

Data from the 1997 survey revealed that recreational vehicles (RVs) accounted for 33% of all overnight stays, and tent camping was the second most popular form of overnight shelter throughout the recreation area. Houseboats contributed about 22% of the total overnight use, group camping accounted for 12% and backcountry overnight use made up less than 6% of the total overnight stays. RVs were the most popular form of overnight accommodation used in the North District (33,738) and tents were the second most popular (21,535). In the South District, houseboats were most often used (32,520), followed by tents (26,988) and recreational vehicles (25, 873) (NPS 2000c). By late June some of the campgrounds are full or overcrowded especially on weekends (EDAW 2002a).

Fishing

There are over 30 species of fish in the lake, and 500,000 rainbow trout and 500,000 kokanee are stocked annually. Other sport fish are walleye, large and small mouth bass, lake whitefish, burbot and yellow perch (Lake Roosevelt Forum 2002). Sturgeon fishing is no longer allowed at Lake Roosevelt due to the dwindling population of this ancient fish (NPS 2002f). As stated earlier 70% of visitors participate in camping and fishing opportunities.

Hiking/Backpacking/Wilderness Experience

Along the lakeshore, Fort Spokane, Spring Canyon and Kettle Falls have the most accessible and well-marked trails. There are also hundreds of secluded beaches, coves and inlets that can be reached by foot or boat.

Shoreline Use

The lands within the recreation area administered by the National Park Service consist of 312 miles of shoreline and 12,036 acres of land. The shorelands consist primarily of a narrow band of land above maximum high water mark (1,290 feet above sea level). The minimum width is determined by the 1,310-foot contour, and the maximum is up to one-half mile from water's edge, with the norm being just a few hundred feet wide. Lake levels fluctuate frequently, sometimes four feet in a 24-hour period.

Roads and hiking trails provide access to much of the Lake Roosevelt shoreline in the North District. On the south end of the reservoir, there are access points but not shoreline roads. Established access points include undeveloped pullouts, trails, developed parking, picnic areas, campgrounds and boat launch areas that are used by personal watercraft. Swimming is allowed along the lake and many campgrounds have designated swim beaches. Popular day-use areas along the shore include the following (NPS 2002c):

- Spring Canyon is a day-use and camping area that receives heavy use. In 1997 there were more than 100,000 recreation visits. There is a one-quarter-mile long sand beach, designated swim area, boat launch, visitor center, and an RV parking area.

- Crescent Bay launch area, just south of the Grand Coulee Dam, has a boat launch and designated swimming area. Anywhere from 12 to 100 vehicles are in the parking lot on summer weekend day. When the Spring Canyon area is full, some visitors utilize this area.

- Keller Ferry is a very popular site, with a marina and ferry service administered by the Colville Tribe. There are 42 houseboats available for rent from this marina. The day-use parking area

and the campground are full every weekend from the Fourth of July through Labor Day and sometimes it is over-crowded. Keller Ferry is a popular fishing place in the fall.

- Hawk Creek camp area is one of the six most popular sites in the South District, with over 60,000 recreation visits in 1997. The site has a boat ramp and a one-mile flat-wake zone.

- Seven Bays marina is one of the four most popular camp areas in the South District. In 1997, the camp area saw more than 100,000 recreation visits. There is a marina with amenities run by the Colville Tribes.

- The Porcupine Bay area receives high use, as this is the closest site to Spokane. The parking lot can have 100 vehicles per day, and it overflows on busy days. The area is developed with boat ramp and swim beach.

- The Fort Spokane area consists of a visitor center, 100-space parking lot, campground, picnic area, a ½ mile water-ski beach and a swim beach. State Road 25 crosses the Spokane Arm connecting NPS-managed facilities to the Two Rivers marina that is run by the Spokane Tribe on the opposite shore. Convenient access to the variety of facilities in the Fort Spokane area contribute to its popularity with visitors, especially those from Spokane. The visitor center and campground had more than 236,000 recreation visits in 1997.

- In the North District, Kettle Falls is by far the most heavily used area, with over 300,000 recreation visits recorded in the 1997 season. The area has a full service marina and store, campground with 76 sites, boat ramp and houseboat rentals. The water is very shallow, and this area can be dry in the spring before lake levels rise.

- Bradbury Beach is a popular day-use area, with swimmers, picnickers, and PWC riders.

- The Hunters boat ramp and campground has the second most use in the North District with nearly 78,000 recreation visits recorded in 1997.

Concessions

There are six full service facilities on the lake that are operated by entities other than the National Park Service: Keller Ferry, Spring Canyon, Two Rivers (on tribal land), Seven Bays, Kettle Falls, and Daisy Station. Services provided may include restaurants, showers, groceries, fishing supplies, slip rental, boat rental (houseboats, aluminum fishing boats, pontoon boats, sailboats, runabouts, kayaks, and speed boats), fuel sales, boat repairs, tour boat services, boat sales and boat mooring.

General Watercraft Use (Motorboats, Canoes and Kayaks)

Motorized watercraft use in the recreation area has occurred since its establishment in 1946 and boating is a primary use of the lake. There are 23 boat ramps and four full service marinas on the lake, including the tribal shoreline. Watercraft at Lake Roosevelt are primarily used for fishing and recreational boating, but are also used to access hunting locations.

Boat launches originating at NPS locations were estimated at approximately 50,000 through trailer counts conducted by park staff in the 2001 summer season. Most boaters reside within 100 miles of Lake

Roosevelt, but others also come from cities and communities throughout Washington as well as from Idaho and Canada.

Watercraft are operated over the entire main surface of the lake, along the shoreline, and in coves and back bays. Peak numbers of motorized boats on Lake Roosevelt can be nearly 1,400 per day. On a typical summer-season day, there could be an estimated 924 vessels on the lake comprised of fishing, pleasure, and high speed boats. Fishing boats comprise an estimated 65% of the boats in the Spring Canyon and Kettle Falls Districts, whereas high-speed boats are more prevalent and comprise approximately 70% of total boats in the Fort Spokane District (NPS 2002 b). The slowest day could have zero boats on the lake due to inclement weather. These numbers represent the main summer season (June through August). During the off-season, fishing boats predominate.

Non-motorized boat activity includes canoes, kayaks, sailboats and sailboards.

PWC Use and Distribution

PWC use began on Lake Roosevelt during the 1980s but did not become common until the mid-1990s. Surveys of boat trailers conducted in 2001 estimated the number of personal watercraft to be approximately 4% of all boating use at the lake. Current peak daily PWC use for the entire reservoir is approximately 56 vessels (see the " PWC and Boating Use" section in the "Environmental Consequences" chapter). Almost 45% of PWC use occurs within the Fort Spokane District. The Spring Canyon and Kettle Falls Districts receive 35% and 20% of the PWC use, respectively. Prior to the November 6, 2002 closure, PWC were permitted to launch, operate, and beach throughout the recreation area. The primary-use season was June through September, due to cold water and cold weather throughout the rest of the year.

Personal watercraft are regulated as vessels under the Superintendent's Compendium. Areas 100 feet around swim beaches, marinas, and in narrow sections of the lake have speed or flat-wake restrictions applicable to all boats including PWC per Washington boating regulations. Flat-wake areas on the lake include Hawk Creek from the waterfall at the campground to an area called "the narrows" and on the Kettle River above the Napoleon Bridge. Crescent Bay Lake is closed to all motorized craft.

Personal watercraft are permitted to operate between dawn and dusk. Activities undertaken by personal watercraft include running up and down sections of the lake, towing water skiers, jumping wakes and general boating activities. PWC are often used as a houseboat accessory.

Prior to the November 6, 2002, PWC closure, no specific additional controls for personal watercraft had been implemented at Lake Roosevelt National Recreation Area. The staff monitored the use of PWC and controls or restrictions could be implemented, if needed, in coordination with the Spokane Tribe of Indians and Confederated Tribes of the Colville Reservation, as well as the state of Washington (NPS 2000c).

Within 100 miles of Lake Roosevelt National Recreation Area there are several other major lakes and many smaller lakes that allow PWC. The larger lakes include Banks Lake and Lake Chelan in Washington and Lake Coeur d'Alene and Lake Pend Oreille in Idaho.

VISITOR SATISFACTION

Throughout the development of the current Lake Roosevelt National Recreation Area *General Management Plan* (GMP) (January 1997 to January 2000), lake users, local and tribal governments, conservation interests, the state's Congressional delegation and the general public were consulted extensively regarding management of the recreation area. Boating, including PWC, was discussed at public meetings, in newsletters, and in the draft and final GMP and associated Environmental Impact Statement. Many people that commented felt that the level of boating and the quality of the experience were satisfactory and that no major changes in management were needed. A few commenters felt that there were too many people who do not respect the regulations, create safety problems by speeding and operating their crafts in an unsafe manner, and they indicated that the National Park Service should step up its enforcement.

Generally, it appeared that most people thought that despite some problem areas, the level of boating activity on the lake was acceptable and that, due to the size of the reservoir, there was still room for visitors to seek and find whatever type of experience that they prefer. Noise was identified as a problem in confined spaces such as in the Spokane Arm of the lake. The predominant sentiment expressed by the public regarding PWC use on Lake Roosevelt during the development of the GMP was "educate first, regulate as needed." The final plan adopted the approach of allowing PWC use to continue subject to additional controls as needed.

Since 1998, 702 written comments concerning PWC have been received by the park. Of these, 73% were in favor of PWC use within Lake Roosevelt, and 27% were opposed. The topics of main concern for those opposed to PWC use in the park are safety, noise and pollution. Those in support of PWC recreation on Lake Roosevelt are also concerned with safety issues. They are supportive of quieter, cleaner machines, and of wake restrictions in certain areas such as coves.

The 2001 Visitor Survey Card (VSC) evaluations indicated a visitor satisfaction rating of 96% (APP 2002). The VSC program was initiated in 1997 as a standard *Government Performance and Results Act* (GPRA) survey that could be used annually by all park units to measure visitor satisfaction.

VISITOR CONFLICTS AND SAFETY

VISITOR SAFETY

A total of 46 boat incidents were reported to the National Park Service on Lake Roosevelt (tribal and NPS waters) from 1997 through 2002. This does not include incidents reported directly to the Tribes. These incidents included any damage to vessels over $500.00, such as propeller damage, scrapes to paint, submerged or grounded vessels as well as collisions. Eight of the 46 incidents involved a PWC, which accounts for 17% of all boating incidents. Nine of the 46 incidents involved two boats making contact with each other, which accounts for 19% of all accidents reported. Five of the nine two-vessel incidents involved at least one PWC. Three of the five PWC incidents involved PWC striking each other.

In 15 boat incidents, someone was injured or died, which accounts for 33% of total incidents. Six of these 15 injury accidents involved a PWC. One PWC accident resulted in the death of the operator. Proportionally, there are more complaints about PWC regarding unsafe behavior than any other watercraft. Complaints regarding noise are received more often concerning other motorized watercraft, such as "cigarette boats," than personal watercraft.

The Lake Roosevelt National Recreation Area *Strategic Plan* states that in order to maintain a safe environment for visitors, the park will be cognizant of visitor activities that threaten visitor safety and will continue to take action to correct safety violations and activities (NPS 2000e).

VISITOR CONFLICTS

Many of the activities undertaken by visitors to Lake Roosevelt National Recreation Area are compatible. For example, swimming, canoeing, fishing and picnicking are all possible along the shoreline and produce little or no conflict between visitors. However, boating near swimmers, fishermen and non-motorized vessels can pose a safety conflict for both parties, and as discussed under "Soundscapes," noise generated by personal watercraft can also affect visitor experiences.

Proportionally, there are more complaints about personal watercraft regarding unsafe behavior than any other watercraft. Some complaints by fishermen, canoeists or swimmers have been received concerning wakes created by personal watercraft, and some complaints have also been received concerning the speed of PWC and of "cigarette boats." More complaints regarding noise have been received concerning motorized watercraft other than personal watercraft.

The following observations have been made by park staff at specific areas on the lake.

- Complaints have been received at Spring Canyon about personal watercraft in the no-wake area around the boat launch. The swim area is adjacent to the launch area, and it is heavily used by swimmers and picnickers. When water levels drop (to below 1,280 feet) PWC and boats end up in the same area as swimmers.

- Keller Ferry area has PWC use, but not at problem levels. There can be three to four PWC at one time using the area.

- Hawk Creek has a boat ramp but not much PWC use, perhaps due to the no-wake zone from the mouth of Hawk Creek to the base of the waterfall.

- At Seven Bays, problems have been reported regarding PWC users racing through the flat - wake zone, and younger riders trying to jump log booms. Marina staff have observed more than 20 PWC on a high-use day.

- Porcupine Bay, the closest area to Spokane, typically has very high visitor use. The boating area is adjacent to the swim area, and conflicts between PWC and visitors have been reported. The park has also received noise complaints from residents on the Spokane Arm of the lake regarding boats.

- Bradbury Beach is a popular day-use area with swimmers, picnickers, and PWC and other watercraft users. Complaints have been made here regarding noise issues and safety issues concerning PWC users jumping wakes too close to other vessels.

RELATED FEDERAL AND STATE PWC REGULATIONS

The state of Washington has PWC specific regulations but they are limited. Among regulations specific to PWC use in Washington, a person must be at least 14 years old to operate a PWC and 16 years old to rent a PWC. There are no state-enforced education mandates for operating PWC. Vendors support increased

PWC regulations due to liability insurance issues. Although some Washington counties, e.g., San Juan, have banned PWC use, it is not anticipated that Lincoln, Ferry, or Stevens counties or the tribes adjacent to the recreation area will act on PWC restrictions. In addition, management on adjacent waters under administration by tribal entities follow state regulations. The managing tribes have no interest in further regulation of PWC use at this time.

CULTURAL RESOURCES

HISTORICAL BACKGROUND

The combination of natural characteristics and resources of the Columbia and Spokane Rivers define the long and complex history of the Lake Roosevelt area. Paleo-Indian use of the area is first documented around 7000 B.C. Over the succeeding generations, the subsistence-based culture expanded to include a range of plant gathering, transplanting of seeds, fishing, and hunting. European contact brought fur traders, settlers, miners, and a military presence to the region.

ARCHEOLOGICAL RESOURCES

The general management plan completed in 1999 indicates that while there are numerous archeological resources in the national recreation area, many were lost during the construction of the Grand Coulee Dam and the inundation of the valley floor that followed. The practice of habitation and use of fishing sites remained constant from prehistoric into historic times. Submerged and shore line sites are most likely to be affected during a draw down by erosion. Hunting, gathering, and sacred sites are more likely in the upper terraces making them less susceptible to erosion concerns. The change in access associated with draw down increases opportunities for looting of all archeological sites (NPS 2000c).

Approximately 80% of the national recreational area above the minimum operating pool of the lake (1,290 feet) has been archeologically surveyed. Lake Roosevelt National Recreation Area currently has 191 archeological sites listed on the FY 1999 NPS Archeological Sites Management Information System (ASMIS) with another 400 documented ethnographic sites having been identified prior to the completion of the general management plan in 1990. Given the substantial archeological survey work that has been completed and the consultation with the Colville and Spokane Tribes regarding cultural resources, it is possible to reasonably predict and avoid sensitive areas (NPS 2002a).

The *Annual Performance Plan* indicates that the principle threat to cultural resources is the erosion caused by the operations of the reservoir. Late winter drawn down by the Bureau of Reclamation can range from 30 to 80 feet depending on anticipated spring run-off. In recent years, lake levels have been affected as early as August. With adjustments occurring during the primary use season, archeological sites are affected by erosion and by an increased opportunity for looting (NPS 2001a).

The national recreation area conducts increased *Archeological Resource Protection Act* (ARPA) patrols when cultural resource sites are exposed during spring draw down of the reservoir. The Bureau of Reclamation has funded some stabilization projects at cultural sites over the years to slow the rate of erosion. Since 1995, the Bonneville Power Administration and the Bureau of Reclamation have funded cultural resource investigations designed to provide baseline information to develop stabilization / mitigation plans for cultural sites threatened by reservoir-caused erosion.

SOCIOECONOMIC ENVIRONMENT

A detailed description of the socioeconomic environment affected by PWC at Lake Roosevelt National Recreation Area is provided in the report "Economic Analysis of Personal Watercraft Regulations in Lake Roosevelt National Recreation Area" (LAW et al. 2002). The following is a brief summary of relevant sections.

Lake Roosevelt National Recreation Area is managed by the National Park Service, the Bureau of Reclamation, the Bureau of Indian Affairs, the Spokane Tribe of Indians, and the Confederated Tribes of the Colville Reservation, as outlined in the 1990 Lake Roosevelt Cooperative Agreement. Washington State boating regulations are enforced on the reservoir by park enforcement staff on NPS-managed waters and by the Spokane and Confederated Colville Tribes on waters under tribal jurisdiction.

The primary origin of visitors to the recreation area is Spokane or other areas of Washington (78%). PWC use at Lake Roosevelt is a minor portion of all visitor activity, and accounts for approximately 4% of boating use on the lake, and less than 1% of overall park visitation. At Lake Roosevelt there are twenty-two sites distributed throughout NPS-managed lands of the park for the launching of motor vessels, including personal watercraft. PWC use primarily occurs on Lake Roosevelt from June through September.

Within 60 to 100 miles of the park, a total of five PWC dealerships were identified in Wenatchee, Spokane, and Okanogan. No PWC dealerships were identified closer to the park. A total of three rental shops were found within 30 miles of the park including Banks Lake, Lake Sun, and Blue Lake. Park staff estimate that approximately 90% of Lake Roosevelt PWC users own their watercraft, while the remainder rent from nearby facilities.

The closest community to the southern portions of the recreation area is in the vicinity of Coulee Dam (population 6,000), made up of the communities of Grand Coulee, Coulee Dam, Elmer City, and Electric City. Communities near the northern portion of the park include Kettle Falls (population 1,000) and Colville (population 10,000). The main industry in the southern portion is farming, while in northern areas lumber, farming, and ranching are the main industries. Spokane (population approximately 200,000) is the largest community in the region and is located approximately 60 miles away.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was issued on February 11, 1994. This order directs federal agencies to evaluate environmental and human health conditions in minority and low-income communities so as to avoid the disproportionate placement of any adverse effects from federal policies and actions on these populations.

At Lake Roosevelt, lands of the Confederated Tribes of the Colville Reservation and Spokane Tribe of Indians border much of the national recreation area boundary along the Columbia and Spokane Rivers, and are inclusive of both waterways to the centerline of the river. Management of Lake Roosevelt is shared by the National Park Service, the Bureau of Reclamation, the Bureau of Indian Affairs, and the two tribes as delineated in the Lake Roosevelt Cooperative Agreement. The National Park Service has full jurisdiction of the national recreation area that extends from Grand Coulee Dam to Onion Creek (south of Northport at river mile 130), as well as some shoreline along both the Spokane River and the Kettle River. The Bureau of Reclamation retains management of the dam, its immediate area, and a few locations that are necessary for operating the dam. Most of the remainder of Lake Roosevelt lies within the boundaries

of the Confederated Tribes of the Colville Reservation and Spokane Tribe of Indians, who have management jurisdiction and enforcement responsibilities within their respective areas.

Recreational use facilities managed under an NPS concession agreement by the Confederated Tribes of the Colville Reservation include the Keller Ferry and Seven Bays marinas and seven campgrounds. Recreational use facilities managed by the Spokane Tribe of Indians include Two Rivers Marina and 10 campgrounds.

U.S. Census 2000 data indicates that out of a combined total population (18 year and older) of 57,510 for the counties surrounding Lake Roosevelt, 37.7% (21,681) are part of a minority community population. Of this percentage, 25.6% (14,722) represent American Indian ancestry primarily within Ferry and Stevens counties where the two tribal reservations are located (U.S. Census Bureau, Census 2000 Redistricting Data).

The economic analysis report prepared for Lake Roosevelt did not specifically identify low-income communities present within the study area, but focused primarily on PWC users and the related business environment and potential impacts (LAW et al. 2002). A review of U.S. Census data (2000) for counties surrounding Lake Roosevelt which include Ferry, Stevens, and Lincoln counties, indicates that the median household income level is between $30,338–$35,255, with Ferry County representing the lower end of the range. The state of Washington median income level is $45,776 (U.S. Census Bureau, Census 2000 Redistricting Data).

NATIONAL RECREATION AREA MANAGEMENT AND OPERATIONS

Lake Roosevelt National Recreation Area currently has eight permanent law enforcement staff positions, and six seasonal staff positions. There are three ranger districts in the recreation area - Kettle Falls, Fort Spokane, and Spring Canyon. During the summer season, rangers are on duty throughout the day and evening in all three districts (EDAW 2003a).

Boat patrols on NPS-managed waters of Lake Roosevelt are conducted on an irregular basis mostly on weekends. Patrols are conducted during the week if warranted by high boating use. Search-and-rescue patrols are infrequent and occur as needed, typically no more than twice annually. Other entities that patrol Lake Roosevelt include the Spokane Tribe of Indians and the Confederated Tribes of the Colville Reservation. Both tribes have daily patrols in their respective areas. Lincoln County conducts boat patrols on busy holiday weekends (EDAW 2003a).

NPS staff indicated that currently, enforcement operations at the recreation area are understaffed by 4–6 positions, and if homeland security (border) requirements are implemented, staff needs would increase further. The recreation area has submitted a request for funding for additional enforcement staff positions (EDAW 2003b).

ENVIRONMENTAL CONSEQUENCES

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and policies guide the National Park Service — the *National Environmental Policy Act* (NEPA) of 1969, and its implementing regulations; the National Parks *Omnibus Management Act of 1998* (NPOMA); and the NPS *Organic Act*.

1. The *National Environmental Policy Act* is implemented through regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500–1508). The National Park Service has in turn adopted procedures to comply with the act and the CEQ regulations, as found in *Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-making* (2001), and its accompanying handbook.

2. The National Parks *Omnibus Management Act of 1998* (NPOMA) (16 USC 5901 et seq.) underscores the *National Environmental Policy Act* in that both are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

3. The *Omnibus Act* directs the National Park Service to obtain scientific and technical information for analysis. The NPS handbook for *Director's Order #12* states that if "such information cannot be obtained due to excessive cost or technical impossibility, the proposed alternative for decision will be modified to eliminate the action causing the unknown or uncertain impact or other alternatives will be selected" (sec. 4.4).

4. Section 4.5 of *Director's Order #12* adds to this guidance by stating "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the regulations of CEQ (40 CFR 1502.22)." In summary, the Park Service must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community.

5. The 1916 NPS *Organic Act* (16 USC 1) commits the Park Service to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

GENERAL METHODOLOGY FOR ASSESSING IMPACTS

While much has been observed and documented about the overall effects of personal watercraft on the environment, as well as public safety concerns, site-specific impacts under all conditions and scenarios are difficult to measure and affirm with absolute confidence. Since personal watercraft were introduced in parks, data collected and interpreted about them and their effects on park resources relative to other uses and influences are difficult to define and quantitatively measure, despite monitoring.

Recognizing this dilemma, the interdisciplinary planning team created a process for impact assessment, based upon the directives of the *Director's Order #12 Handbook* (sec. 4.5(g)). National park system units are directed to assess the extent of impacts on park resources as defined by the context, duration, and intensity of the effect. While measurement by quantitative means is useful, it is even more crucial for the public and decision-makers to understand the implications of those impacts in the short and long term, cumulatively, and within context, based on an understanding and interpretation by resource professionals and specialists. With interpretation, one can ascertain whether a certain impact intensity to a park resource is "minor" compared to "major" and what criteria were used to base that conclusion.

To determine impacts, methodologies were identified to measure the change in park resources that would occur with the implementation of the PWC management alternatives. Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives.

Potential impacts are described in terms of type (Are the effects beneficial or adverse?), context (Are the effects site-specific, local, or even regional?), duration (Are the effects short-term, lasting less than one year, or long-term, lasting more than one year?), and intensity (Are the effects negligible, minor, moderate, or major?). Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document.

Each alternative is compared to a baseline to determine the context, duration, and intensity of resource impacts. For purposes of impact analysis, the baseline is the reinstatement of personal watercraft use as previously managed projected over the next 10 years (alternative A). In the absence of quantitative data, best professional judgment was used to determine impacts. In general, the thresholds used come from existing literature on personal watercraft, federal and state standards, and consultation with subject matter experts and appropriate agencies.

In addition to establishing impact thresholds, the national recreation area's resource management objectives and goals (as stated in the "Purpose of and Need for Action" chapter) were integrated into the impact analysis. In order to further define resource protection goals relative to PWC management, the park's *Strategic Plan* was used to ascertain the "desired future condition" of resources over the long term. The impact analysis then considers whether each management alternative contributes substantially to the park's achievement of its resource goals, or would be an obstacle. The planning team then considered potential ways to mitigate effects of personal watercraft on park resources, and the alternatives were modified accordingly.

For the purposes of analysis, the following assumptions are used for all impact topics:

> *Short-term impacts*: Those impacts occurring from PWC use in the immediate future (per trip through a single season of use, usually 1 to 6 months).
>
> *Long-term impacts*: Those impacts occurring from PWC use over several seasons of use through the next 10 years.
>
> *Direct impacts*: Those impacts occurring from the direct use or influence of PWC use.
>
> *Indirect impacts*: Those impacts occurring from PWC use that indirectly alter a resource or condition.

Impact analysis area: Specific analyses apply only to NPS-managed portions of the Lake Roosevelt National Recreation Area. The cumulative impacts apply to both NPS- and tribal-managed portions of Lake Roosevelt and the surrounding shoreline. Each resource impact is assessed in direct relationship to those resources affected both inside and outside the park, to the extent that the impacts can be substantially traced, linked, or connected to PWC use inside park boundaries. Each impact topic, therefore, has an impact analysis area relative to the resource being assessed, and it is further defined in the impact methodology.

CUMULATIVE IMPACTS

The CEQ regulations to implement the *National Environmental Policy Act* require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Lake Roosevelt and, if applicable, the surrounding region, as discussed in the "Purpose of and Need for Action" chapter.

IMPAIRMENT ANALYSIS

The NPS *Management Policies 2001* require an analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, as established by the *Organic Act* and reaffirmed by the *General Authorities Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within a park system unit, that discretion is limited by the statutory requirement that the agency must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park.

The following process was used to determine whether the various PWC management alternatives had the potential to impair park resources and values:

1. The park's authorizing legislation, the *2000 General Management Plan* (NPS 2000c), the *Fiscal Year 2001 – 2005 Strategic Plan* (NPS 2000e), and other relevant background were reviewed with regard to the unit's purpose and significance, resource values, and resource management goals or desired future conditions.

2. PWC management objectives specific to resource protection goals at the park were identified.

3. Thresholds were established for each resource of concern to determine the context, intensity and duration of impacts, as defined above.

4. An analysis was conducted to determine if the magnitude of impact reached the level of "impairment," as defined by NPS *Management Policies*.

The impact analysis includes any findings of impairment to park resources and values for each of the management alternatives.

PWC AND BOATING USE TRENDS

Current and future PWC use trends were identified to determine direct and indirect impacts of PWC management strategies on resources within the recreation area. Other watercraft use trends were also identified to assist in assessment of cumulative impacts. Recent PWC use was estimated using park and marina staff observations in addition to NPS parking lot trailer counts. Future PWC use trends were determined using park visitation data, Washington boating statistics, and regional population statistics.

CURRENT USE ESTIMATES

Watercraft use at Lake Roosevelt is highest in the summer months. PWC use is seasonally limited and the highest use occurs from June through September due to cold water temperatures the remainder of the year. Boating use continues year round, though winter use is much lower than in summer months. Use during winter months is primarily related to fishing activities.

Although no annual counts are conducted of visitors accessing the recreation area by boat or personal watercraft, park staff conducts trailer counts in launch site parking lots during the summer boating season. In 2001, park trailer counts at NPS launch sites resulted in a summer boating estimate of approximately 50,000 vessels. PWC use at Lake Roosevelt was found to be approximately 4% of total boating. Park staff observations were also made within each ranger district (Spring Canyon, Fort Spokane, and Kettle Falls) to determine peak day use on the lake (see table 12). These estimates for peak day use included all boats on the water, regardless of launch site, whereas the parking lot trailer count data applied only to launches from NPS sites. The peak use estimates were prorated based on estimated visitor use levels per season (derived from the *2000 General Management Plan* [NPS 2000]) to yield daily figures and ultimately annual use figures for both personal watercraft (4,486) and other vessels (112,498) (see table 12).

TABLE 12: ESTIMATED ANNUAL WATERCRAFT USE LAKE ROOSEVELT NATIONAL RECREATION AREA

Level of Use per Season	Days per Year	Lake Roosevelt National Recreation Area Districts — Boats and PWC per day						All Districts					
		Spring Canyon District		Fort Spokane District		Kettle Falls District		Total Daily Motorized Vessels[a]			Annual Motorized Vessels[b]		
		Boats	PWC	Boats	PWC	Boats	PWC	Boats	PWC	Total	Boats	PWC	Total
Peak use day (Fourth of July)	4	480	20	576	24	288	12	1344	56	1,400	5376	224	5,600
Typical summer season day[c] (July – Aug)	58	317	13	380	16	190	8	887	37	924	51446	2146	53,592
Medium use days[d] (June and Sept)	60	158	7	190	8	95	4	443	19	462	26580	1140	27,720
Low use days[e] (April, May, Oct, Nov)	122	63	3	76	3	38	2	177	8	185	21594	976	22,570
Very low use days[f] (Dec – Mar)	121	22	0	27	0	13	0	62	0	62	7502	0	7,502
								Total Annual Use			**112,498**	**4,486**	**116,984**

Source: Lake Roosevelt staff observations and 2001 trailer surveys; NPS 2000c recreation visits by month.

a. PWC use is estimated at 4% of motorized boating activity on Lake Roosevelt according to staff observations (for example, peak use days: 1,344 boats + 56 PWC = 1,400 total vessel).

b. Annual figures are derived from daily totals multiplied by number of days/year for each corresponding use level.

c. Average summer boating and PWC use is approximately two-thirds or 66% of peak day use based on LARO staff observations.

d. Medium use days occur in June and September (summer shoulder seasons) and are estimated at 50% of July/August visitation based on "1997 Recreation Visits by Month" presented in table 9 of the Lake Roosevelt General Management Plan (NPS 2000c).

e. Low use days are estimated at 15–20% of July/August visitation based on "1997 Recreation Visits by Month" presented in table 9 of the Lake Roosevelt General Management Plan (NPS 2000c).

f. Some limited use occurs during the winter months (estimated at 7% of July/August visitation).

From these observations and estimations, PWC numbers on Lake Roosevelt are estimated as follows. Spring Canyon District averages 20 personal watercraft on a peak use day (Fourth of July) and 13 on a typical summer-season day (July through August); Fort Spokane District averages 24 personal watercraft on a peak use day and 16 on a typical summer-season day; and Kettle Falls District averages 12 personal watercraft on a peak use day and 8 on a typical summer-season day, for a lake total of 56 personal watercraft on peak day and 37 on a typical summer-season day. These estimates are presented in table 12 for each district as well as for the entire reservoir. Current peak daily PWC use for the entire reservoir is 56 vessels. Peak watercraft use at Lake Roosevelt occurs during the July 4 weekend unless the weather is not conducive to boating, in which case peak use occurs on July 15.

Because the reservoir is narrow throughout most of its length, PWC and other motorized watercraft are assumed to operate on both NPS- and tribal-managed waters, regardless of launch point during an average trip on the water. Motorized watercraft, including PWC, could not be separated between tribal and NPS-managed waters when recreating on the lake.

Estimations were also made for annual and peak activity originating from NPS launch sites versus launch sites on tribal lands. Only NPS launch sites and administered waters at Lake Roosevelt would be affected by the action alternatives described within this environmental assessment. In the no-action alternative, PWC use would only be eliminated from NPS-managed waters. Based on current PWC use patterns, it is assumed that PWC use on tribal waters would continue and that some PWC users that launch from NPS launch sites would be displaced to tribal launch facilities. Therefore, it was necessary to determine how many PWC users would move from the National Park Service to tribal launch sites if the national recreation area was closed to PWC use (no-action alternative).

The Two Rivers Marina is the only major non-NPS launch point for the reservoir and accounts for a large portion of boating activity within the Fort Spokane District. Marina staff estimated peak day use originating from Two Rivers. Seasonal visitor use assumptions were used to calculate motorized watercraft use figures on a seasonal and annual basis. Table 13 summarizes the NPS and non-NPS peak and annual boating activity at Two Rivers Marina.

Under the no-action alternative, the Two Rivers Marina launch ramp would be the only legal and viable place to launch personal watercraft on Lake Roosevelt. The Two Rivers Marina is the only developed launch point on reservation lands and accounts for a substantial portion of launches in the Fort Spokane District (table 12). Under the no-action alternative, it is assumed that PWC use that currently occurs in the Fort Spokane District would continue due to the convenient access to the Two Rivers Marina. Approximately 40% of total current PWC use at Lake Roosevelt or 1,870 personal watercraft would continue to use the tribal waters of the lake annually (24 personal watercraft on a peak day). Of those 1,870 personal watercraft that would continue to use the reservoir, 466 would relocate their launch activities from NPS lands to tribal lands. As shown in table 13, the majority of PWC operators in the Fort Spokane district already launch from the Two Rivers Marina.

Additionally, 10% to 20% of PWC users from the Kettle Falls and Spring Canyon districts would also relocate to the Two Rivers Marina for launching purposes (262 personal watercraft annually; 3 personal watercraft peak day use – assumed 10% per district). It is assumed under the no-action alternative that the remainder of PWC users that recreate in these two districts would no longer operate their personal watercraft on Lake Roosevelt due to inconvenience associated with launching from a non-NPS launch site. Park staff indicated that some individuals would continue to launch from NPS lands under a ban; however, estimation of how many would violate the ban is not possible. Table 14 presents the assumed scenario under the no-action alternative. The total peak day use for personal watercraft on tribal portions of the reservoir under the no-action alternative is 27 personal watercraft while annual use would equal 2,132 personal watercraft.

TABLE 13: ESTIMATED PEAK DAY USE AND ANNUAL BOATING NUMBERS NPS VERSUS NON-NPS LAUNCHES

	Non-NPS Launches (Two Rivers Marina)[a]		NPS Launches[b]		All of Lake Roosevelt[c]	
	Boats	PWC	Boats	PWC	Boats	PWC
Peak Use Days	376	60	5,000	164	5,376	224
Totals	9,597	1,404	102,901	3,082	112,498	4,486

Source: Lake Roosevelt staff observations and 2001 trailer surveys; Lake Roosevelt GMP recreation visits by month; Two Rivers Marina staff observations (JNS 2002).

a. Derived from peak day estimates given by marina staff for the July 4 weekend.

b. Numbers derived from subtracting Two Rivers Marina launches from All of Lake Roosevelt launches.

c. Totals of boating activity from all areas within Lake Roosevelt as derived from table 12.

TABLE 14: ESTIMATED PWC USE UNDER THE NO-ACTION ALTERNATIVE ON LAKE ROOSEVELT, 2002

Unit of time	Fort Spokane District[a] (Number of PWC)	Spring Canyon District[b] (Number of PWC)	Kettle Falls District[c] (Number of PWC)	All of Lake Roosevelt (Number of PWC)
Peak day	24	2	1	27
Annual	1870	162	100	2132

a. 100% of Spokane PWC use would continue, 25% of which previously launched from NPS launches, but would relocate to Two Rivers Marina to launch.

b. 10% of Spring Canyon District PWC use would continue and launch from Two Rivers Marina.

c. 10% of Kettle Falls District PWC use would continue and launch from Two Rivers Marina.

ENGINE AND VESSEL TYPES

The composition of non-PWC motorized vessels that are typically active in each district during the summer season was estimated by park staff. Boat types were assumed to include three categories; high-speed inboards, outboard engine fishing vessels, and outboard pleasure vessels. Table 15 displays the estimated boat types totaled for the entire recreation area that were derived from park district estimates. For impact analysis purposes, total inboard and outboard engines were also calculated as shown. Personal watercraft are not included in this table but were assumed to be outboard engines.

FUTURE USE TRENDS

PWC and boating use trends were estimated based on population, boating registration, and park visitation trends. Census data for the State of Washington as well as the six-county region surrounding Lake Roosevelt National Recreation Area shows an average percent growth in population of approximately 1.3% (table 16) over the next 8 years. Visitation data for Lake Roosevelt shows a fluctuation of total visits between approximately 1.1 million and 1.8 million from 1991–2001 with no steady trend (NPS 2000c). Washington boating registration data from 1996–2000 shows an average percent annual change of 1.15% (table 17). PWC registration data was not available for the state. Based on the above data, personal watercraft and other watercraft are estimated to increase 1% for the next 10 years.

Assuming a 1% annual increase in PWC and boating use, PWC use would increase from 56 personal watercraft in 2002 to 62 personal watercraft on a peak use day in 2012. Personal watercraft and other boating use would increase from 1,400 to 1,547 vessels on a peak day over the 10-year period (see table 18). These peak day use figures are used to calculate water quality impacts and are converted to annual use to determine air quality impacts. These figures will be discussed in more detail in these respective sections.

TABLE 15: ESTIMATED COMPOSITION OF NON-PWC MOTORIZED VESSELS ON LAKE ROOSEVELT, 2002

Non-PWC Boat Type	Number of Boats	Percent of Non-PWC Boats
High speed - Inboard	40,220	35.8%
Fishing - Outboard	51,396	45.7%
Pleasure - Outboard	20,882	18.6%
All boats	**112,498**	**100.0%**
Outboard	72,278	64.2%
Inboard	40,220	35.8%

TABLE 16: POPULATION PROJECTIONS, SIX-COUNTY REGION SURROUNDING LAKE ROOSEVELT NATIONAL RECREATION AREA

Population Projection					
County	2000	Annual Percent Change	2005	Annual Percent Change	2010
Douglas	32,603	2.2%	36,257	1.6%	39,196
Ferry	7,260	1.6%	7,901	1.2%	8,384
Grant	74,696	2.0%	82,397	1.44%	88,381
Lincoln	10,164	-0.02%	10,095	0.6%	10,366
Okanogan	39,564	0.96%	41,458	1.24%	44,061
Stevens	40,066	1.0%	42,105	2.12%	46,585
Six-County Region[a]		**1.29%**		**1.36%**	
Statewide[b]		**1.3%**		**1.31%**	

Source: Washington State County Population Projections for Growth Management by Age and Sex: 2000–2025; January 2002 Projections (medium). www.ofm.wa.gov/pop/gma/countypop.pdf.

a. Annual % change in population for Douglas, Ferry, Grant, Lincoln, Okanogan, and Stevens counties combined between 2000, 2005, and 2010. These six counties are in vicinity of Lake Roosevelt National Recreation Area.

b. Estimated annual % change in population for state of Washington between 2000, 2005, and 2010.

TABLE 17: WASHINGTON BOAT REGISTRATION STATISTICS, 1996–2000

Year	Boat Registrations	Annual Percent Change
1996	246,174	
1997	245,962	-0.1
1998	249,968	1.6
1999	250,606	0.3
2000	257,625	2.8
Average Percent Change		**1.15**

Source: National Marine Manufacturers Association (NMMA) 1999 Recreational Boating Registration Statistics (NMMA 2000)

TABLE 18: PROJECTED INCREASE IN PEAK DAILY AND ANNUAL WATERCRAFT USE AT LAKE ROOSEVELT NATIONAL RECREATION AREA

Year[a]	Peak Daily Boating Use (total motorized vessels)	Lake Roosevelt National Recreation Area Districts						All Districts	
		Spring Canyon District		Fort Spokane District		Kettle Falls District		Annual Use	
		Boats	PWC[b]	Boats	PWC[b]	Boats	PWC[b]	Boats	PWC[b]
2002	1,400	480	20	576	24	288	12	112,498	4,486
2006	1,458	499	21	599	25	300	12	117,066	4,668
2012	1,547	530	22	636	27	318	13	124,267	4,955

a. Annual increase in boating and PWC use was assumed to be 1% per year based on state and regional population projections for the state of Washington, average annual increase in Washington state boating registrations, and lack of consistent growth in park visitation over the past 5 to 10 years.

b. PWC use is estimated at 4% of boating activity on Lake Roosevelt according to staff observations.

WATER QUALITY

Most research on the effects of personal watercraft on water quality focuses on the impacts of two-stroke engines, and it is assumed that any impacts caused by these engines also apply to the personal watercraft powered by them. There is general agreement that two-stroke engines discharge a gas-oil mixture into the water. Fuel used in PWC engines contains many hydrocarbons, including BTEX. PAH also are released from boat engines, including those in personal watercraft. These compounds are not found appreciably in the unburned fuel mixture, but rather are products of combustion. Discharges of all these compounds — BTEX and PAH — have potential adverse effects on water quality. A common gasoline additive, MTBE, is currently being used in the state of Washington; however, a ban on its use will take effect on December 31, 2003 (US DOE 2002).

A typical conventional (i.e., carbureted) two-stroke PWC engine discharges as much as 30% of the unburned fuel mixture directly into the water (NPS 1999; CARB 1999). At common fuel consumption rates, an average two-hour ride on a personal watercraft may discharge 3 gallons of fuel into the water (NPS 1999). According to the California Air Resources Board (CARB 1998), an average personal watercraft can discharge between 1.2 and 3.3 gallons of fuel during one hour at full throttle.

As described below, hydrocarbon (HC) discharges to water are expected to decrease substantially over the next 10 years due to mandated improvements in engine technology (EPA 1996a, 1997).

GUIDING REGULATIONS AND POLICIES

The Environmental Protection Agency has developed national recommended ambient water quality criteria for approximately 120 priority pollutants for the protection of both aquatic life and human health (related to ingestion of fish/shellfish or water) (EPA 1999a). These criteria have been adopted as enforceable standards by most states. The Environmental Protection Agency has not established any criteria for the protection of aquatic life for any of the PWC-related compounds stated above. For the human health criteria, however, the Environmental Protection Agency has established criteria for benzene, ethylbenzene, toluene, and several PAH compounds. There are no criteria for xylene.

The NPS *Management Policies 2001* state that the Park Service will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations" (sec. 4.6.3).

Lake Roosevelt does not have quantitative water quality data documenting the effects of personal watercraft. To address water quality impacts that would potentially result from reinstated PWC use, water quality benchmarks were used in the absence of unit-specific data as a basic principle to guide the analysis.

Simply stated, a water quality standard defines the water quality goals for a waterbody by designating uses to be made of the water, by setting minimum criteria to protect the uses, and by preventing degradation of water quality through antidegradation provisions. The antidegradation policy is only one portion of a water quality standard. Part of this policy (40 CFR 131.12(a)(2)) strives to maintain water quality at existing levels if it is already better than the minimum criteria. Antidegradation should not be interpreted to mean that "no degradation" can or will occur, as even in the most pristine waters, degradation may be allowed for certain pollutants as long as it is temporary and short term (NPS 2001d).

Other considerations in assessing the magnitude of water quality impacts is the effect on those resources dependent on a certain quality or condition of water. Sensitive aquatic organisms, submerged aquatic

vegetation, riparian areas, and wetlands are affected by changes in water quality from direct and indirect sources.

While many parks do have established water quality monitoring programs, the specific organic compounds emitted from personal watercraft are not systematically measured. In the absence of park-specific data, available water quality benchmarks or criteria and estimated discharge rates of organics were used as the basic tools to address water quality impacts potentially resulting from PWC use.

METHODOLOGY AND ASSUMPTIONS

In order to assess the magnitude of water quality impacts to park waters under the various PWC management alternatives, the following methods and assumptions were used:

1. The regulation at 40 CFR 131.12(a) (2) represents an overall goal or principle with regard to PWC use in that the park will strive to fully protect existing water quality so that "fishable / swimmable" uses and other existing or designated uses are maintained. Therefore, PWC use could not be authorized to the degree that it would lower this standard and affect these uses. To do so would potentially violate 40 CFR 131.10, which basically forbids the removal of an existing use (e.g., personal watercraft) because the activity was authorized knowing this level of pollution would occur.

2. State water quality standards governing the waters of the park were examined for pollutants whose concentration levels in gasoline were available in the literature and for which ecotoxicological and/or human health toxicity benchmarks were available in the literature.

3. Baseline water quality data (if available), especially for pollutants associated with two-stroke engines (PAH, hydrocarbons), were examined. MTBE may still be found in gasoline sold in Washington prior to the effective date of the ban (12-31-03) and is included in the analysis.

4. Since no models were available to predict concentrations in water of selected pollutants emitted by personal watercraft and motorboats, an approach was developed to provide estimates of whether PWC (and outboard motor) use over a particular time (for example, over a typical busy weekend day) would result in exceedances of the identified standards, criteria, or toxicity benchmarks. The approach is described in appendix A. Results of this approach were then taken into account, along with site-specific information about currents, mixing, wind, turbidity, as well as the specific fate and transport characteristics of the pollutant involved (e.g., volatility), to assess the potential for the occurrence of adverse water quality impacts.

5. In general, the approach provides the information needed to calculate emissions to the receiving waterbody from personal watercraft (and, by estimation, from outboard motors) of selected hydrocarbons whose concentrations in the raw gasoline fuel were available in the literature and for which ecotoxicological and/or human health toxicity benchmarks could be acquired from the literature. The selected chemicals were benzene, MTBE and three PAH (benzo (a) pyrene, naphthalene, and 1-methyl naphthalene). The approach outlined a procedure to first estimate the emissions of these pollutants to the water per operational hour (based on literature values) and to then estimate the total loading of the pollutants into the water, based on the estimated hours of use. The approach then provided an estimate of how much water would be required to dilute the calculated emission loading to the level of the water quality standard or benchmark. That volume of water (referred to as the "threshold volume of water") was then compared to the total available volume of water.

State of Washington surface water quality standards for toxic substances (WAC 173, section 201A-040) do not specifically list benzene, MTBE and the three PAH. Thus, the EPA human health based water quality criteria found in 40 CFR 131.36 (EPA 2002c) for water and organisms are used.

The applicable Washington toxic substances water quality standards for Lake Roosevelt were compared with the respective EPA standards and other benchmarks, and the lower, more restrictive, of the two sets of standards were used. (By complying with the more restrictive benchmarks, both state and federal criteria are satisfied.) Table 19 shows the criteria and benchmarks used to assess water quality impacts.

6. The principal mechanisms that result in loss of the pollutant from the water were also considered. Many organic pollutants that are initially dissolved in the water volatilize to the atmosphere, especially if they have high vapor pressures, are lighter than water, and mixing occurs at the air/water interface. Other compounds that have low vapor pressure, low solubility, and high octanol/water partition coefficients tend to adhere to organic material and clays and eventually adsorb onto sediments. By considering movements of the organics through the water column, an assessment can be made as to whether there could be an issue with standards or benchmarks being exceeded, even on a short-term basis.

7. The threshold volume of water was calculated in acre-feet (1 acre-foot = 1 acre of water 1 foot deep). For example, if results showed that for benzo(a)pyrene, 55 acre-feet of water would be needed to dilute the expected emissions to below the benchmark level, and the receiving body of water is a 100-acre reservoir with an average depth of 20 feet (= 2000 acre-feet) and is well-mixed, then this would indicate little chance of a problem, especially when adding the effects of any other processes that contribute to the loss of benzo(a)pyrene from the water column. However, if the impact area is a 5-acre backwater averaging 2 feet deep (10 acre-feet), then there may be at least a short-term issue, especially if outboard emissions are added or there is little mixing in the area.

TABLE 19: ECOTOXICOLOGICAL BENCHMARKS AND HUMAN HEALTH CRITERIA FOR ORGANIC CHEMICALS

Chemical	Ecotoxicological Benchmark (µg/L)	Source	Human Health Criteria[b] (µg/L)	Source
Benzo(a)pyrene	0.014	Suter and Tsao 1996	0.0028	EPA 2002c
Naphthalene	62	Suter and Tsao 1996	—	—
1-methyl naphthalene	34[a]	USFWS 2000	—	—
Benzene	130	Suter and Tsao 1996	1.2	EPA 2002c
MTBE[c]	51,000	Mancini et al. 2002	13	CA DHS 2002

a. Based on LC_{50} of 34 µg/L used for freshwater calculations.

b. Based on the consumption of water and fish.

c. Ecotoxicological benchmarks, which are considered preliminary chronic water quality criteria, are 18,000 µg/L for marine and 51,000 µg/L for freshwater. There is no EPA human health benchmark, but the California Department of Health Services (2002) has established a primary maximum contaminant level (MCL) of 13 µg/L.

8. To assess cumulative impacts, emissions from other motorized boats were also determined, based on estimates of relative emissions of unburned fuel and hours of use. Emissions from two-stroke, carbureted outboard engines and high speed or ski boats (typically four-stroke or direct injection engines) at the park were then added to PWC emissions to yield a more complete estimation of loading to the receiving water body. Several studies have demonstrated that four-stroke engines are substantially cleaner than carbureted two-stroke engines, generating approximately 90% fewer emissions (NALMS 1999). Oregon Department of Environmental Quality estimates emissions from four-stroke and direct-injection two-stroke engines to be from 75% to 95% cleaner (ODEQ 1999). A distinction is made in the water quality analysis in order to differentiate between the two-stroke, carbureted outboard engines and the cleaner four-stroke, or two-stroke direct injection engines (high speed or ski boats). The total emissions calculated from the numbers of high speed or ski boats will be reduced by 90%. The estimates used for relative loading from various engine types are obtained from available data.

9. Estimated reductions in emissions from personal watercraft and outboards are outlined by the Environmental Protection Agency over the next 10 years (see table 20).

   Key dates in this chronology begin with 1999, when the Environmental Protection Agency began to require production line testing for 75% HC reduction in new outboard motors, and 2000, when testing for 75% HC reduction in personal watercraft was started. By 2006 all new personal watercraft and outboards manufactured in the United States must have a 75% reduction in HC emissions. In 2005 and 2012 overall reductions in HC emissions are estimated to be 25% and 50%, respectively, in PWC and outboard motors. These estimates are based on estimates of the emissions reduction percentages and associated years reported by the Environmental Protection Agency (1996a), but with a one-year delay in the implementation of production line testing (EPA 1997). The 50% reduction estimated for 2012 was used in the calculations for alternatives A, B and no-action in this assessment.

10. To evaluate water quality impacts at Lake Roosevelt National Recreation Area, water volumes and water quality calculations were analyzed for the mixing zone defined for Lake Roosevelt. Approximately 58% of Lake Roosevelt lies within the jurisdictional boundary of the national recreation area. The remaining 42% is managed by the Colville Confederated Tribes and Spokane Tribe of Indians. The volume of water available at minimum pool is approximately 3.9 million acre-feet. Applying a jurisdictional boundary to the available volume would reduce it to approximately 2.3 million acre-feet. As discussed in the "Affected Environment" chapter, the volume of the reservoir at minimum pool, as reduced by the jurisdictional boundary, would be available as a mixing zone because of the short retention time of water in the reservior. The short retention time prohibits the formation of a thermocline and allows the entire volume to mix freely.

TABLE 20: ESTIMATED EPA REDUCTIONS IN WATERCRAFT EMISSIONS

Date	Action
1999	EPA requires production line testing for 75% HC reduction in new outboards and begins to see reductions as newer models are introduced (EPA 1997).
2000	EPA requires production line testing for 75% HC reduction in new personal watercraft and begins to see reductions as newer models are introduced (EPA 1997).
2005	Estimated 25% reduction in HC emissions overall as a result of newer models being gradually used (EPA 1996a; date modified in EPA 1997).
2006	EPA fully implements production line testing for 75% HC reduction in new outboards and personal watercraft (EPA 1996a).
2012	Estimated 50% reduction in HC emissions overall (EPA 1996a; date modified in EPA 1997).

11. PWC and motorboat numbers are provided at the beginning of this chapter under "PWC and Other Boating Use Trends." PWC and boating use for the entire reservoir reflecting peak use days (Fourth of July and Labor Day) were used for the assessment of impacts to NPS-managed waters as explained in the "PWC and Boating Use Trends" section. These estimates were based on Park staff observations and statistics from various sources including visitor use information, regional population, and boating registration statistics. Estimation of the total motorized vessels (personal watercraft and other motorized boats) per day for the peak use days for 2002 was 1,400. Of that total, the number of personal watercraft are estimated to be approximately 56 two-stroke carbureted engines (4% of the total motorized vessels). The total number of other motorboats estimated to operate at the reservoir during peak use days was approximately 1,344. Of the 1,344 motorboats, 864 are assumed to be two-stroke, carbureted outboard engines (fishing and pleasure type boats) and 480 are assumed to be high speed or ski boats, which typically have four-stroke, or direct injection engines. Annual increases in boating and PWC use of 1% from 2002 to 2012 were assumed. Using this assumption, an estimation of the total motorized vessels per day for the peak use days for 2012 was 1,547. Of that total, the number of personal watercraft are estimated to be approximately 62 (4% of the total motorized vessels). The total number of other motorboats estimated to operate at the reservior during peak use days was approximately 1,485. Of the 1,485 motorboats, 955 are assumed to be two-stroke, carbureted outboard engines and 530 are assumed to be high speed or ski boats.

    The following describes how PWC and motorboat operations were evaluated to determine potential water quality impacts at Lake Roosevelt:

    - The majority of motorboats operating within the Lake Roosevelt are assumed to have two-stroke, carbureted outboard engines. All motorboats are assumed to have engines larger than 15 horsepower. High speed or ski boats (using four-stroke and direct injection engines) are included in the analysis, assuming a 90% reduction of the resulting emissions.

    - Hours of use per various vessel types are based on park staff estimates. It is assumed that personal watercraft are active for three hours per day, and high speed and ski boats are active for 4.5 hours per day. Fishing boats are estimated to be active for seven hours per day, but only one hour of this would be at full throttle. The remaining six hours would be spent at slow trolling speeds while fishing. For the six hours at trolling speed, it was assumed that fuel discharge rates are ¼ of that at full throttle. This is equivalent to a total of 2.5 hours at full throttle for fishing vessels.

    - Concentration of MTBE added to gasoline varies between 2002 and 2012 because of the anticipated ban on the use of MTBE effective December 31, 2003. It was assumed that 10% by volume of MTBE is added to gasoline under the analysis for 2002. In 2012, after the ban on MTBE will have been in place for nine years, the limit set by the state of Washington for MTBE in gasoline not to exceed 0.6 of one percent by volume was used (see Affected Environment, Water Quality).

    - When released to water, benzene is subject to rapid volatilization, with a half-life for evaporation of about 5 hours (EPA 2001). The loss of benzene from the water column is discussed qualitatively where applicable.

    - Some research shows that PAH, including those from PWC emissions, adversely affect water quality via harmful phototoxic effects on ecologically sensitive plankton and other small water organisms (EPA 1998; Oris et al. 1998; Landrum et al. 1987; Mekenyan et al. 1994; Arfsten et al. 1996). This research indicates that PAH may have phototoxic effects at

very low concentrations (less than 1 µg/L) in clear lakes with limited production of organic matter and high light penetration in shallow waters (Oris et al. 1998). Light penetration at Lake Roosevelt is greatest at the dam where water is also the deepest, and decreases upstream due to suspended sediment from the Columbia River (NPS 1997). If PWC and other motorboat use was concentrated in shallow arm areas, such as Kettle River and Hawk Creek, there could be an increase in photoxic effects from PAH in lake sediments. However, this is not the case due to flat-wake restrictions and the shallow nature of these areas.

IMPACT ANALYSIS AREA

The impact analysis area for water quality includes Lake Roosevelt within the NPS jurisdictional boundary of the Lake Roosevelt National Recreation Area. Cumulative analysis also includes statements regarding effects to waters managed by the the Colville Confederated Tribes and the Spokane Tribe of Indians.

IMPACT TO WATER QUALITY FROM PWC USE

Given the above water quality issues and methodology and assumptions, the following impact thresholds were established in order to describe the relative changes in water quality (both overall, localized, short and long term, cumulatively, adverse and beneficial) under the various PWC management alternatives.

Negligible: Impacts are chemical, physical, or biological effects that would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.

Minor: Impacts (chemical, physical, or biological effects) would be detectable but would be well below water quality standards or criteria and within historical or desired water quality conditions.

Moderate: Impacts (chemical, physical, or biological effects) would be detectable but would be at or below water quality standards or criteria; however, historical baseline or desired water quality conditions would be altered on a short-term basis.

Major: Impacts (chemical, physical, or biological effects) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would be slightly and singularly exceeded on a short-term basis.

Impairment: Impacts are chemical, physical, or biological effects that would be detectable and that would be substantially and frequently altered from the historical baseline or desired water quality conditions and/or water quality standards, or criteria would be exceeded several times on a short-term and temporary basis. In addition, these adverse, major impacts to park resources and values would:

- Contribute to deterioration of the park's water quality and aquatic resources to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation;

- Affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

- Affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use would be reinstated within Lake Roosevelt in all locations of the recreation area where it was allowed prior to November 6, 2002. PWC use would be allowed throughout the recreation area with the following restrictions:

- Crescent Bay Lake (motorized watercraft restricted);

- Upper Kettle River, above the Napoleon Bridge (flat-wake);

- Upper Hawk Creek from the waterfall near the campground through the area known as the "narrows" (flat-wake);

- One hundred feet from swim areas and boat launches (minimum speed necessary to maintain steerageway).

It is acknowledged that PWC and other motorboats would not be operating at full throttle and would have variable discharge rates in flat-wake zones and around swim and boat launch areas. However, due to the small aerial extent of these flat-wake zones coupled with the limited time spent in these areas by PWC and other motorized vessels, the effects on water quality are not likely to be detectable. Focus will remain on operation of these vessels in the non-restricted areas of Lake Roosevelt.

PWC use would also continue to be allowed on those portions of Lake Roosevelt managed by the Colville Confederated Tribes and Spokane Tribe of Indians. Launch and retrieval of personal watercraft would be permitted at designated boat launch ramps within Lake Roosevelt. Regardless of launch site, PWC users would be expected to operate on waters of Lake Roosevelt that are under jurisdiction of both NPS and the tribal entities. PWC users would be permitted to land anywhere along the shoreline, except at designated swim beaches.

Numbers of personal watercraft using the lake during a high-use day are estimated to be 56 in 2002 with an increase to 62 in 2012, an average increase of 1% per year. In 2012, the emissions calculated reflect a 50% reduction applied in order to incorporate EPA estimates of engine conversion based on the 1996 EPA industry regulations (EPA 1996a). Three hours of use per day was used in the calculation of pollutant loading from personal watercraft to the reservoir.

An estimate of how much water would be required to dilute the calculated emission loading from personal watercraft to the level of the water quality standard or benchmark is shown in table 21. That volume of water (referred to as the "threshold volume of water") was then compared to the total available volume of water in the mixing zone within the NPS-managed waters of Lake Roosevelt (2.3 million acre-feet).

TABLE 21: THRESHOLD WATER VOLUMES NEEDED TO DILUTE PWC EMISSIONS – ALTERNATIVE A

	Water Volumes Needed for Dilution (acre-feet)	
	2002	2012
Volume of water available in mixing zone	2,274,741 acre-feet	
Ecotoxicological Benchmarks[a]		
Benzo(a)pyrene (fuel and exhaust)	232	129
Naphthalene	92	51
1-methyl naphthalene	262	145
Benzene	220	122
MTBE[c]	2	0
Human Health Benchmarks[b]		
Benzo(a)pyrene (fuel and exhaust)	747	643
Benzene	23,801	13,176
MTBE[c]	8,776	291

a. Threshold volume (in acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (in acre-feet) below which human health might be impacted.

c. MTBE assumed at 10% by volume in 2002 and 0.6 of 1% in 2012.

The 2002 and 2012 threshold volumes to meet ecotoxicological benchmarks range from 0 to 262 acre-feet. These volumes are extremely small in relation to the volumes of water available (2.3 million acre-feet in available mixing zone of NPS waters of Lake Roosevelt), indicating that these pollutant loads would result in concentrations well below the ecotoxicological benchmarks. Consequently, negligible adverse impacts are expected in 2002 and in 2012.

Threshold volumes required to meet human health benchmarks were also well below the volume available in NPS-managed waters . In 2002 and 2012 the threshold volume required to meet these human health benchmarks would range from 291 to 23,801 acre-feet, resulting in long-term, negligible adverse impacts.

The most limiting estimated threshold water volume required to meet human health benchmarks is for benzene. The threshold volumes required to meet the benzene human health benchmark are 23,801, and 13,176 acre-feet, for 2002 and 2012, respectively. For benzene, factors other than those discussed above that affect surface water concentrations (especially volatilization) also are considered, but were not incorporated into the estimate of threshold volume. The half-life of benzene in water is less than 5 hours at summer water temperatures near 30°C (Verschuren 1983; EPA 2001). In other words, half the benzene in water would evaporate in less than 5 hours.

Because of the 50% reduction in PWC and outboard motorboat engine emissions estimated by the EPA (1997) and because PWC use would only increase from 56 to 62 on a peak day, pollutant loads in 2012 would be lower than in 2002.

Cumulative Impacts. In addition to the personal watercraft that use Lake Roosevelt National Recreation Area, other two-stroke outboard motorboats, and to a lesser degree the high speed and ski boats would contribute pollutants to the water. A total of 1,344 non-PWC vessels in 2002 and 1,485 non-PWC vessels in 2012 are estimated during a peak use day. Table 22 shows how these vessels are distributed for the analysis of cumulative impacts.

TABLE 22: DISTRIBUTION OF VESSEL TYPE DURING PEAK USE DAYS, LAKE ROOSEVELT NATIONAL RECREATION AREA

Vessel Type	Number of Vessels	
	2002	2012
Carbureted two-stroke, fishing boats, pleasure boats	864	955
High-speed and ski boats	480	530
PWC, two-stroke, carbureted engine	56	62
Total Vessels	**1,400**	**1,547**

Emissions were calculated for each vessel type for both 2002 and 2012 (see table 23). Emissions from high speed or ski boats were assumed to be 10% of emissions calculated for two-stroke outboard engines or for personal watercraft (assuming all personal watercraft have two-stroke, carbureted engines). These emissions were summed. In 2012, the emissions calculated reflect a 50% reduction applied in order to incorporate EPA estimates of engine conversion based on the 1996 EPA regulations (EPA 1996a).

The calculated threshold volumes for pollutants emitted in 2002 by personal watercraft and other motorboats in NPS-managed waters are approximately an order of magnitude greater than the threshold volumes due to personal watercraft alone. The cumulative threshold volumes based on ecotoxicological benchmarks would range from 41 to 6,854 acre-feet in 2002. Effects would be long-term because impacts from cumulative sources occur annually during each boating season. In 2012, ecotoxicological threshold volumes would decrease to a range of 1 to 3,786 acre-feet, despite an estimated 1% annual increase in the numbers of personal watercraft and other motorboats, because of the reduction of emissions expected from clean engine technology. The threshold volume for MTBE decreases even more dramatically in 2012 because of the ban on its use beginning in 2004. Concentrations of all the organic contaminants evaluated are well below the water quality benchmarks and would likely not be detectable. Cumulative adverse ecological impacts would be negligible in both 2002 and 2012.

Based on the human health benchmarks, the calculated threshold volumes for benzo(a)pyrene emitted by personal watercraft and boats in 2002 and 2012 in NPS manged waters would be 20,646 and 11,637 acre-feet, respectively. The calculated threshold volume for benzene for 2002 and 2012 would be 431,254 and 238,295 acre-feet, respectively, resulting in negligible adverse impacts. The threshold volume for benzene in 2012 would be lower than in 2002 because of the 50% reduction in PWC and outboard motorboat engine emissions estimated by the Environmental Protection Agency (1997). Threshold volume required for dilution for MTBE would be 159,017 acre-feet in 2002 and be reduced to 5,272 acre-feet after the implementation of the ban on MTBE in 2012. The benzo(a)pyrene, benzene, and MTBE threshold volumes would be substantially lower than the available water volumes under NPS jurisdiction, and therefore, would result in negligible, long-term, adverse impacts to human health.

As noted in the water quality methodology and assumptions section, the available water volume for the above calculations includes water within NPS jurisdictional boundaries only, and does not account for all of the volume available to dilute pollutants across the whole reservoir. Cumulative impacts from all watercraft use on Lake Roosevelt would also similarly affect tribal managed waters because motorized watercraft use the entire lake surface irrespective iof the jurisdictional boundary.

Conclusion. Alternative A would have negligible adverse effects on water quality based on ecotoxicological threshold volumes due to the reinstatement of PWC use in NPS-managed waters at Lake Roosevelt. Cumulative pollutant loads in 2002 and 2012 from personal watercraft and other motorboats would be well below ecotoxicological benchmarks and criteria.

TABLE 23: THRESHOLD WATER VOLUMES NEEDED TO DILUTE ALL VESSEL EMISSIONS – ALTERNATIVE A

	Water Volumes Needed for Dilution (acre-feet)	
	2002	2012
Volume of water available in mixing zone	2,274,741 acre-feet	
Ecotoxicological Benchmarks[a]		
Benzo(a)pyrene (fuel and exhaust)	6,854	3,786
Naphthalene	1,667	921
1-methyl naphthalene	4,742	2,620
Benzene	3,981	2,200
MTBE[c]	41	1
Human Health Benchmarks[b]		
Benzo(a)pyrene (fuel and exhaust)	20,646	11,637
Benzene	431,254	238,295
MTBE[c]	159,017	5,272

a. Threshold volume (in acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (in acre-feet) below which human health might be impacted.

c. MTBE assumed at 10% by volume in 2002 and 0.6 of 1% in 2012.

Adverse water quality impacts from personal watercraft from benzo(a)pyrene, benzene and MTBE based on human health (ingestion of water and fish) benchmarks would be negligible in both 2002 and 2012, based on EPA and state of Washington water quality criteria. Cumulative impacts from personal watercraft and other watercraft would be negligible adverse and long-term for benzo(a)pyrene, benzene and MTBE. Cumulative impacts from personal watercraft and other motorboats to water quality would also be applicable to tribal managed waters.

Implementation of alternative A would not result in an impairment of the water quality resource.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. As under alternative A, PWC use would be reinstated within Lake Roosevelt in all locations of the recreation area where it was allowed prior to November 6, 2002. In addition to the current flat-wake areas (upper Kettle River and Hawk Creek) and the restriction on motorized watercraft use on Crescent Bay Lake, additional flat-wake speed zoning would be implemented. These flat-wake restriction would apply to the following areas:

- Within 200 feet from launch ramps, marina facilities, campgrounds, swim beaches, water skiers and other persons in the water;

- The Spokane Arm from 100 feet west of the Two Rivers Marina on the downstream end, to 100 feet east of the launch ramp on the upstream end, above the vehicle bridge.

These additional flat-wake restrictions do not change the direct or indirect impacts on water quality in NPS-managed waters of Lake Roosevelt from personal watercraft relative to alternative A. Since personal watercraft are assumed to operate for only short periods of time in flat-wake zones, effects from low

throttle operation in these areas would likely be insignificant. Therefore, calculations only address full throttle operation in the main body of the reservoir. However, it is aknowledged that emissions could potentially build up in areas where use is heavy such as around launch facilities and shallow water high activity areas where flat-wake zoning would be extended. Alternative B would also establish a resource monitoring program addressing water quality sampling for watercraft emissions in areas of high PWC and motorized vessel use. These efforts would assist in the detection and future prevention of adverse impacts from PWC and other boating use in the above flat-wake areas.

Numbers of vessels in 2002 and 2012 remain the same and results of analysis are the same as under alternative A.

Cumulative Impacts. As in alternative A, cumulative adverse impacts from personal watercraft and other watercraft would be negligible and long-term for benzo(a)pyrene, benzene and MTBE. Additional flat-wake zone restrictions would not change the cumulative impacts on water quality in NPS or tribal managed waters.

Conclusion. The adverse impacts to water quality from alternative B would be the same as alternative A. Although additional flat-wake restrictions would be implemented in some areas, effects from low throttle operation would not measurably change water quality impacts to NPS-managed waters.

PWC use under alternative B would have negligible adverse effects on water quality based on ecotoxicological threshold volumes. Cumulative pollutant loads in 2002 and 2012 from personal watercraft and other motorboats would be well below ecotoxicological benchmarks and criteria. Adverse water quality impacts from personal watercraft from benzo(a)pyrene, benzene and MTBE based on human health (ingestion of water and fish) benchmarks would be negligible in both 2002 and 2012, based on EPA and state of Washington water quality criteria. Cumulative adverse impacts from personal watercraft and other watercraft would be negligible for benzo(a)pyrene, benzene and MTBE. Cumulative impacts from personal watercraft and other motorboats to water quality would also be applicable to tribal managed waters.

Implementation of alternative B would not result in an impairment of the water quality resource at Lake Roosevelt.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative, PWC use would not be reinstated within Lake Roosevelt National Recreation Area, resulting in the elimination of impacts to water quality in NPS-managed waters. However, PWC use would continue in Lake Roosevelt outside the boundaries of the national recreation area and some personal watercraft that previously launched from NPS sites would be displaced to tribal launch facilities.

Cumulative Impacts. Cumulative emissions in NPS-managed waters of Lake Roosevelt would be less than under alternative A because of the elimination of PWC use from the National Recreation Area portion of the reservoir. Cumulative effects from activity of motorboats on an average high-use day would be the same as described under the previous alternatives, increasing from an estimated 1,344 boats in 2002 to 1,485 boats in 2012. Assumptions for hours of use for each vessel type remain the same as in alternatives A and B.

Threshold volumes in both 2002 and 2012 based on ecotoxicological benchmarks for pollutants and based on the human health benchmarks for benzo (a) pyrene, benzene and MTBE are all substantially lower than the water volumes available. Therefore, emissions from motorboat activity would have a negligible, long-term adverse impact on water quality in NPS-managed waters.

The estimated threshold volumes for benzene, based on EPA water quality criteria, is again, the most limiting. Threshold volumes for benzene (human health based) are 418,928 and 248,389 acre-feet in 2002 and 2012. However, these adverse impacts are expected to be negligible even without considering the effects of the half life of benzene (see table 24).

PWC use originating from tribal launch sites would continue in tribal managed waters. This use combined with other motorized watercraft use would continue to affect water quality of tribal-managed waters and would be similar to cumulative impacts under alternatives A and B. The contribution to cumulative effects on tribal managed waters (42% of the 3,921,967 acre-feet total lake volume at minimum pool) from continued and displaced PWC use would be negligible as shown in table 25.

Conclusion. PWC use would not be reinstated within NPS-managed waters of Lake Roosevelt, resulting in long-term beneficial impacts due to the elimination of pollutant loads in these waters from personal watercraft. Cumulative impacts from motorboats would be negligible and long term for all ecotoxicological and human health benchmarks, as in other alternatives.

The contribution of PWC to cumulative impacts in NPS-managed waters would be eliminated. Cumulative impacts from motorized boats would be negligible and long term for all ecotoxicological and human health benchmarks, as in other alternatives. Continued PWC use on tribal managed waters would contribute to negligible adverse cumulative impacts from watercraft activity to quality of waters under tribal jurisdiction.

Implementation of this alternative would not result in an impairment of the water resource.

TABLE 24: THRESHOLD WATER VOLUMES NEEDED TO DILUTE BOATING EMISSIONS IN NPS-MANAGED WATERS OF LAKE ROOSEVELT – NO-ACTION ALTERNATIVE

	Water Volumes Needed for Dilution (acre-feet)	
	2002	2012
Volume of water available in mixing zone	2,274,741 acre-feet	
Ecotoxicological Benchmarks[a]		
Benzo(a)pyrene (fuel and exhaust)	6,621	2,364
Naphthalene	1,575	936
1-methyl naphthalene	4,481	2,661
Benzene	3,761	2,234
MTBE[c]	38	1
Human Health Benchmarks[b]		
Benzo(a)pyrene (fuel and exhaust)	19,898	11,819
Benzene	407,453	242,014,
MTBE[c]	150,241	5,354

a. Threshold volume (in acre-feet) below which ecotoxicological effects might occur.

b. Threshold volumes (in acre-feet) below which human health might be impacted.

c. MTBE assumed at 10% by volume in 2002 and 0.6 of 1% in 2012.

TABLE 25: THRESHOLD WATER VOLUMES NEEDED TO DILUTE PWC EMISSIONS IN TRIBAL MANAGED WATERS OF LAKE ROOSEVELT– NO-ACTION ALTERNATIVE

	Water Volumes Needed for Dilution (acre-feet)	
	2002	2012
Volume of water available in mixing zone	1,647,226 acre-feet[a]	
Ecotoxicological Benchmarks[b]		
Benzo(a)pyrene (fuel and exhaust)	**112**	**62**
Naphthalene	44	25
1-methyl naphthalene	126	70
Benzene	106	59
MTBE[c]	1	0
Human Health Benchmarks[c]		
Benzo(a)pyrene (fuel and exhaust)	560	311
Benzene	11,476	6,375
MTBE[d]	4,231	141

a. Water available for mixing under tribal jurisdiction (42% of lake volume at minimum pool).

b. Threshold volume (in acre-feet) below which ecotoxicological effects might occur.

c. Threshold volumes (in acre-feet) below which human health might be impacted.

d. MTBE assumed at 10% by volume in 2002 and 0.6 of 1% in 2012.

AIR QUALITY

Personal watercraft emit various compounds that pollute the air. Up to one third of the fuel delivered to the typical two-stroke carbureted PWC engine is unburned and discharged; the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as volatile organic compounds (VOC), nitrogen oxides (NO_x), particulate matter (PM), and carbon monoxide (CO). Personal watercraft also emit fuel components such as PAH that are known to cause adverse health effects.

Even though PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gases go into the air. These air pollutants may adversely impact park visitor and employee health as well as sensitive park resources. For example, in the presence of sunlight VOC[2] and NO_x emissions combine to form ozone (O_3). O_3 causes respiratory problems in humans, including cough, airway irritation, and chest pain during inhalations (EPA 1996c). O_3 is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA 1996c). CO can affect humans as well. It interferes with the oxygen carrying capacity of blood, resulting in lack of oxygen to tissues. NO_x and PM emissions associated with PWC use can also degrade visibility (CARB 1997; EPA 2000b). NO_x can also contribute to acid deposition effects on plants, water, and soil.

2. Hydrocarbon emissions from internal combustion are characterized in various references and regulations as total hydrocarbons (THC), hydrocarbons (HC), volatile organic compounds (VOC), and reactive organic gases (ROG), as well as other terms. While there are technical differences among some of these terms, the quantitative differences are negligible for purposes of this environmental analysis. The remainder of this discussion describes all hydrocarbon emissions as HC, which is the term used in the EPA regulation for control of emissions from marine engines.

However, because emission estimates show that NO_x from personal watercraft are minimal (less than 5 tons per year), acid deposition effects attributable to personal watercraft use are expected to be minimal.

GUIDING REGULATIONS AND POLICIES

Clean Air Act. The *Clean Air Act* established national ambient air quality standards (NAAQS) to protect the public health and welfare from air pollution. The act also established the prevention of significant deterioration (PSD) of air quality program to protect the air in relatively clean areas. One purpose of this program is to preserve, protect, and enhance air quality in areas of special national or regional natural, recreational, scenic, or historic value (42 USC 7401 et seq.). The program also includes a classification approach for controlling air pollution.

- Class I areas are afforded the greatest degree of air quality protection. Very little deterioration of air quality is allowed in these areas, and the unit manager has an affirmative responsibility to protect visibility and all other Class I area air quality related values from the adverse effects of air pollution. The land owned by the Colville Confederated Tribe and Spokane Tribe of Indians adjacent to Lake Roosevelt are designated Class I areas.

- Class II areas include all national park system areas not designated as Class I, and the *Clean Air Act* allows only moderate air quality deterioration in these areas. In no case, however, may pollution concentrations violate any of the national ambient air quality standards. Lake Roosevelt National Recreation Area is designated a Class II area.

Conformity Requirements. National park system areas that do not meet the national ambient air quality standards or whose resources are already being adversely affected by current ambient levels require a greater degree of consideration and scrutiny by NPS managers. Areas that do not meet national air quality standards for any pollutant are designated as nonattainment areas. Section 176 of the *Clean Air Act* states:

> No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan [of the State]. . . . [T]he assurance of conformity to such a plan shall be an affirmative responsibility of the head of such department, agency or instrumentality.

Essentially, federal agencies must ensure that any action taken does not interfere with a state's plan to attain and maintain the national ambient air quality standards in designated nonattainment and maintenance areas. In making decisions regarding PWC use within a designated nonattainment or maintenance area, park managers should discuss their plans with the appropriate state air pollution control agency to determine the applicability of conformity requirements. Lake Roosevelt is within an attainment area for all pollutants, so the conformity requirements do not apply to this unit.

Applicable PWC Emission Standards. The Environmental Protection Agency issued the gasoline marine engine final rule in August 1996. The rule, which took effect in 1999, affects manufacturers of new outboard engines and the type of inboard engines used in personal watercraft. The agency adopted a phased approach to reduce emissions. The current emission standards were set at levels that are achievable by existing personal watercraft. By 2006 PWC manufacturers will be required to meet a corporate average emission standard that is equivalent to a 75% reduction in HC emissions. (The corporate average standard allows manufacturers to build some engines to emission levels lower than the standard and some engines to emission levels higher than the standard, and to employ a mix of technology types, as long as the overall corporate average is at or below the standard.) In 1996, the

Environmental Protection Agency estimated an overall 52% reduction in hydrocarbon emissions from marine engines from present levels by 2010, and a 75% reduction by 2030, based on phasing out polluting machines. The 1997 EPA rule delayed implementation by one year (EPA 1996a, 1997).

In July 2002, the Environmental Protection Agency proposed new evaporative emissions standards for gasoline-fueled boats and personal watercraft. These proposed standards would require most new boats produced in 2008 or later to be equipped with low-emission fuel tanks or other evaporative emission controls.

NPS Organic Act and Management Policies. The NPS *Organic Act of 1916* (16 USC 1, et seq.) and the NPS *Management Policies* guide the protection of park and wilderness areas. The general mandates of the *Organic Act* state that the National Park Service will:

> promote and regulate the use of . . . national parks . . . by such means and measures as conform to the fundamental purpose of the said parks, . . . which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (16 USC 1).

Under its 2001 *Management Policies* the National Park Service will:

> seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas (sec. 4.7.1).

The Management Policies further state that the NPS will assume an aggressive role in promoting and pursuing measures to protect air quality related values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the NPS "will err on the side of protecting air quality and related values for future generations."

The *Organic Act* and the *Management Policies* apply equally to all areas of the national park system, regardless of *Clean Air Act* designations. Therefore, the National Park Service will protect resources at both Class I and Class II designated units. Furthermore, the NPS *Organic Act* and *Management Policies* provide additional protection beyond that afforded by the Clean Air Act's national ambient air quality standards alone because the National Park Service has documented that specific park air quality related values can be adversely affected at levels below the national standards or by pollutants for which no standard exists.

METHODOLOGY AND ASSUMPTIONS

In order to assess the level of PWC air quality impacts resulting from a given management alternative, the following methods and assumptions were used:

1. The national ambient air quality standards and state/local air quality standards as presented in the "Affected Environment" chapter (if applicable) were examined for each pollutant.

2. Air quality designations for the surrounding area were determined. Lake Roosevelt is in an attainment area for each pollutant.

3. There is no monitoring location near the recreation area that provides representative ambient data. Based on data from the WDOE, Air Quality Program, as described in the "Affected Environment" chapter, all highest maximum concentrations for each pollutant are below the national ambient air quality standards (NAAQS).

4. Typical use patterns of motorized watercraft were identified as outlined in the "PWC and Boating Use Trends" section.

5. The rated horsepower, average engine load, and other relevant parameters for each watercraft type were taken from default assumptions in the EPA NONROAD model. This model is used to calculate emissions of criteria pollutants from the operation of nonroad spark-ignition type engines, including personal watercraft. The model allows assumptions to be made regarding the mix of engine types that will be phased in as new engine standards come into effect, and increasing numbers of personal watercraft will be of the cleaner-burning four-stroke type.

6. Hydrocarbon emissions from internal combustion are characterized in various references and regulations as total hydrocarbons (THC), hydrocarbons (HC), volatile organic compounds (VOC), and reactive organic gases (ROG), as well as other terms. While there are technical differences among some of these terms, the quantitative differences are negligible for purposes of this environmental analysis. The remainder of this discussion describes all hydrocarbon emissions as HC, which is the term used in the EPA regulation for control of emissions from marine engines.

7. PAH are released during the combustion of fuel, though some PAH are also found in unburned gasoline. Kado et al. 2000 indicated that changing from two-stroke carbureted engines to two-stroke direct-injection engines may result in increases of airborne particulate-associated PAH. The same study indicated that four-stroke engines have considerably less PAH emissions than two-stroke engines[3]. A subsequent study of airborne emissions indicated a potential health risk from toxic pollutants in areas of high concentration of exhaust from many engines, such as in an engine maintenance shop (Kado, Kuzmicky, and Okamoto 2001).

8. Any reductions in emissions resulting from implementing control strategies were taken into account, as were changes in emissions resulting from increased or decreased usage.

9. Studies regarding ozone injury on sensitive plants found in the recreational area were requested, but none were available for Lake Roosevelt. There is no evidence of effects from ozone on plants within the recreation area.

10. A calculation referred to as SUM06 (ppm-hours) was used for assessing regional ozone exposure levels. These data are collected from rural and urban monitoring sites. The highest three-month, five-year average commonly used for the area was determined by reviewing ambient air quality data (available from the NPS Air Resources Division).

11. Visibility impairment was determined from local monitoring data, or from qualitative evidence such as personal observations and photographs.

12. The air quality impacts of the various alternatives were assessed by considering the existing air quality levels and the air quality related values present, and by using the estimated emissions

3. It is noted that only one engine of each type, two-stroke carbureted, two-stroke direct injection, and four-stroke, was tested.

and any applicable, EPA-approved air quality models. Estimated reductions in HC emissions would be the same as those described for water quality.

13. For cumulative impacts, the assessment was completed quantitatively with respect to anticipated use of the recreational area by other recreational watercraft based on emission factors and assumption in EPA's NONROAD model. Types of craft assessed for quantitative cumulative impacts included outboard spark-ignition type engines and personal watercraft. Other sources of air pollutants in the area were also considered in the cumulative analysis through a review of the state implementation plan, county records, and the use of best professional judgment.

14. Pollutant emissions were calculated for 2002 and 2012. As described in the "Water Quality" section, estimates of watercraft use were based on park staff observations and statistics from various sources including the *General Management Plan*, Washington State population projections and National Marine Manufacturers Association boating registration statistics. For 2002, it was assumed that there were 116,984 combined PWC and boat trips, as shown previously in table 12 in the "PWC and Boating Use Trends" section. PWC use was assumed at 4,486 machines, each of which was assumed to engage in one trip that was 3 hours in duration (approximately 4% of all watercraft trips). The non-PWC trips were assumed to be 72,278 outboard engine boats (64.2% of non-PWC) and 40,220 inboard engine boats (35.8%). The outboard engine boats include fishing boats, with an average 2.5 hour trip, and pleasure boats, with and average 4.5 hour trip. Inboard boats were assumed to include the high-speed boats with average trip duration of 4.5 hours. For 2002, it was assumed that all PWC and outboard engines at Lake Roosevelt National Recreation Area were carbureted two-stroke (dirty) engines, and that all inboard engines were four-stroke (clean) engines.

    Between 2002 and 2012, some carbureted two-stroke personal watercraft and outboards would be replaced with watercraft with the cleaner direct injection two-stroke, electric fuel injection two-stroke, or four-stroke engines. This replacement would occur as a result of the EPA requirement for manufacturers to supply the cleaner engines. Consistent with EPA forecasts, it was assumed that the introduction of cleaner engines would result in a 50 percent reduction of HC emissions for each engine type by 2012.

    It was also assumed that 50% of the replaced carbureted two-stroke personal watercraft would be direct injection two-stroke, and 50% would be four-stroke. Twenty-five percent of the replaced carbureted two-stroke outboards would be direct injection two-stroke, 25% would be electric fuel injection two-stroke, and 50% would be four-stroke.

PWC impact thresholds for air quality are dependent on the type of pollutants produced, the background air quality, and the pollution-sensitive resources (air quality related values) present. Impact thresholds may be qualitative (e.g., photos of degraded visibility) or quantitative (e.g., based on impacts to air quality related values or federal air quality standards, or emissions based), depending on what type of information is appropriate or available.

Two categories for potential airborne pollution impacts from personal watercraft are analyzed: impacts on human health resources and impacts on air quality related values in the impact analysis area. Thresholds for each impact category (negligible, minor, moderate, and major) are discussed for each impact topic.

IMPACT ANALYSIS AREA

The impact analysis area includes the immediate location of PWC use and the surrounding national recreation area where air pollutants may accumulate. More specifically, the impact analysis area is Lake Roosevelt plus a 100-foot-wide strip inland. It is assumed that air pollutants would dissipate beyond 100 feet due to air currents.

IMPACT TO HUMAN HEALTH FROM AIRBORNE POLLUTANTS RELATED TO PWC USE

The following impact thresholds for an attainment area have been defined for analyzing impacts to human health from airborne pollutants — CO, PM_{10}, HC, and NO_x. Sulfur oxides (SO_x) are not included because they are emitted by personal watercraft in very small quantities.

	Activity Analyzed		**Current Air Quality**
Negligible:	Emissions would be less than 50 tons/year for each pollutant.	and	The first highest 3-year maximum for each pollutant is less than NAAQS.
Minor:	Emissions would be less than 100 tons/year for each pollutant.	and	The first highest 3-year maximum for each pollutant is less than NAAQS.
Moderate:	Emissions would be greater than or equal to 100 tons/year for any pollutant.	or	The first highest 3-year maximum for each pollutant is greater than NAAQS.
Major:	Emissions levels would be greater than or equal to 250 tons/year for any pollutant.	and	The first highest 3-year maximum for each pollutant is greater than NAAQS.

Impairment — Impacts would:

- Have a major adverse effect on park resources and values; or
- Contribute to deterioration of the park's air quality to the extent the park's purpose could not be fulfilled as established in its authorizing legislation; or
- Affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or
- Affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Both HC and NO_x are ozone precursors in the presence of sunlight and are evaluated separately in lieu of ozone, which is formed as a secondary pollutant. (Note that in attainment areas the *Clean Air Act* does not require that NO_x be counted as an ozone precursor).

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under this alternative, the use of NPS-managed waters of Lake Roosevelt by personal watercraft would be reinstated and managed under the management strategies that were in place before the park was closed to PWC use. Based on data provided in the "PWC Use and Boating Use Trends" section, PWC annual use was estimated to be 4,486 personal watercraft in 2002, increasing at approximately 1% annually to 4,955 personal watercraft in 2012. Due to the narrow and linear

characteristics of the reservoir, each personal watercraft that launches is assumed to recreate on waters managed by both NPS and tribal entities during an average trip, regardless of launch point.

The impacts to human health from airborne pollutants from PWC use are presented in table 26. Adverse impacts related to PWC use in 2002 would be minor for CO and negligible for HC, PM_{10} and NO_x. In 2012, human-health-related air quality impacts reflect the predicted 1% annual increase in PWC activity and a forecasted 50% reduction in engine HC emission rates compared to 1998. Reductions in emissions of all pollutants would occur as a result of new engine technology required by the Environmental Protection Agency, except for NO_x, which is predicted to increase by a very small amount. This increase would occur because the design in two-stroke direct-injection and four-stroke engines required to achieve substantial HC reductions results in slightly higher NO_x emissions. As a result, impacts to human health from PWC air pollutants in 2012 would be minor for CO and negligible for HC, PM_{10} and NO_x.

As carbureted two-strike engines are converted to cleaner engines, some increase in PAH emissions could occur related to two-stroke direct-injection engines (Kado et al. 2000). However, these increases would be offset by the reduction in PAH that would occur with conversion to four-stroke engines. The human health risk from PAH would be negligible in 2002 and 2012.

Cumulative Impacts. Emissions of motorized boats are assessed quantitatively in combination with personal watercraft, taking into consideration regional and local air pollution sources. As described in the "Methodology and Assumptions" section for air quality, boats accounted for approximately 96% of the annual motorized watercraft activity within the national recreation area in 2002. NPS and other data, as previously described, estimated non-PWC use at an estimated 112,498 boats per year in 2002, increasing to 124,267 boats per year in 2012. The combined emissions from personal watercraft and other boats are provided in table 27. Overall, cumulative adverse impacts to human health from airborne pollutants in 2002 would be negligible for PM_{10} and NO_x, and moderate for HC and CO based on the quantities of emissions and maximum pollutant levels that are less than the NAAQS.

Combined emissions of CO would increase from 2002 to 2012. This would occur because two types of cleaner (i.e., reduced HC) outboard engines – fuel injection two-stroke and four-stroke – have higher CO emissions than the carbureted two-stroke engines. As boating increases annually and two-stroke engines are replaced with these cleaner engines, CO emissions would also increase. Although monitoring data are not available for CO in the area within the national recreation area, ambient CO levels are assumed to be below NAAQS within this area, based on data from the WDOE, and reportedly low traffic congestion. High local CO usually occurs in areas of severe traffic congestion on major urban roadways, which is not the situation within the national recreation area. The introduction of cleaner engines would also result in an increase in NO_x.

TABLE 26: PWC EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT LAKE ROOSEVELT NATIONAL RECREATION AREA– ALTERNATIVE A

	CO		PM_{10}		HC		NO_x	
	2002	2012	2002	2012	2002	2012	2002	2012
Annual Emissions (tons/year)	80	70	1.8	1.4	40	22	0.2	0.8
Impact Level	Minor	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

TABLE 27: PWC AND MOTORIZED BOAT EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT LAKE ROOSEVELT – ALTERNATIVE A

	CO		PM_{10}		HC		NO_x	
	2002	2012	2002	2012	2002	2012	2002	2012
Annual Emissions (tons/year)	1568	1802	21	17	356	217	44	57
Impact Level	Moderate	Moderate	Negligible	Negligible	Moderate	Moderate	Negligible	Minor

Emission rates of HC would be reduced by approximately 39% between 2002 and 2012 as a result of technological improvements in marine engines, even with an estimated 1% increase in motorized boating activity at Lake Roosevelt. Additional cumulative emissions reductions beyond 2012 are likely, as manufacturers implement EPA regulations targeted at improving motorized watercraft engine performance.

Overall, cumulative adverse impacts to human health from airborne pollutants in 2012 would be negligible for PM_{10}, minor for NO_x, and moderate for HC and CO. Cumulative impacts from watercraft emissions would also be applicable to adjacent areas under tribal jurisdiction.

Conclusion. PWC use in NPS-managed waters would result in negligible adverse impacts to human heath related to the airborne pollutants HC, PM_{10} and NO_x, and minor adverse impacts from CO for the year 2002. The risk from PAH would also be negligible. In 2012, there would be a negligible increase in NO_x emissions and a decrease in emissions of the other pollutants, although the impact level for these pollutants would remain the same as in 2002.

Cumulative emission levels from boating use on NPS-managed waters of Lake Roosevelt would be negligible for PM_{10}, and moderate for HC and CO in 2002 and 2012. NO_x emissions would be negligible in 2002 and minor in 2012. CO and NO_x emissions would increase from 2002 to 2012 because of increased boating activity and cleaner engines that have higher CO and NO_x emissions. Although there would be an increase in NO_x emissions in 2012, the greater reduction in HC emissions would result in a beneficial impact to regional ozone concentrations. Therefore, this alternative would maintain or improve existing air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. Overall, PWC emissions of HC are estimated to be 10% to 11% of the cumulative boating emissions in 2002 and 2012. Cumulative impacts from watercraft emissions would also be applicable to adjacent areas under tribal jurisdiction. All impacts would be long term.

Implementation of this alternative would not result in an impairment of air quality.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under this alternative, PWC use of NPS-managed waters of Lake Roosevelt would be reinstated with some additional restrictions to the management strategies in force prior to the closure. The additional restrictions would extend flat-wake requirements at launch ramps, campgrounds and other visitor use areas and in a portion of the Spokane Arm in the Two Rivers area.

The additional restrictions would not change the type of personal watercraft in use nor increase or decrease the number of personal watercraft forecast between 2002 and 2012. As a result, human-health air quality impacts from alternative B would be the same as alternative A for 2002 and 2012, and would be minor for CO and negligible for HC, PM_{10}, and NO_x. The human health risk from PAH would also be negligible in 2002 and 2012.

Cumulative Impacts. Under alternative B, cumulative impacts from boating use on NPS-managed waters of Lake Roosevelt would be the same as alternative A. Adverse impacts to human health from air pollutants in 2002 would be negligible for PM_{10} and NO_x, and moderate for HC and CO. In 2012, levels for PM_{10} would remain negligible and HC and CO would remain moderate, while NO_x would increase to minor due to an implementation of new engine technology and an increase in boating use. Cumulative impacts would also be applicable to areas under tribal jurisdiction.

Conclusion. Alternative B would result in the same air quality impacts to human health from PWC emissions as alternative A. Additional management prescriptions would not noticeably affect PWC emissions. As in alternative A, negligible adverse impacts for HC, PM_{10} and NO_x, and minor impacts for CO would occur for 2002 and 2012. The risk from PAH would also be negligible in 2002 and 2012.

Cumulative adverse impacts from PWC and other boating emissions within the national recreation area would be the same as for alternative A, and would be moderate for CO and HC, and negligible for PM_{10} and NO_x in 2002. In 2012, NO_x impact would increase to minor; impacts for the other pollutants would remain at 2002 levels. A beneficial impact to regional ozone emissions would occur due to a reduction in HC emissions. This alternative would maintain or improve existing human health air quality conditions, with future reductions in PM_{10} and HC emissions due to improved emission controls. The PWC contribution to emissions of HC is estimated to be 10% to 11% of the cumulative boating emissions in 2002 and 2012. Cumulative impacts from watercraft emissions would also be applicable to adjacent areas under tribal jurisdiction. All impacts would be long term.

Implementation of this alternative would not result in an impairment of air quality.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative PWC use would not be reinstated in the national recreation area, resulting in the elimination of PWC emissions in NPS-managed areas. There would be no contribution of CO, PM_{10}, HC, and NO_x emissions from personal watercraft within the national recreation area boundary, resulting in long-term, beneficial impacts in localized areas. PWC activity would continue in the waters under jurisdiction of the Spokane and Colville Confederated Tribes and some displacement of PWC to tribal launch facilities and waters would occur.

Cumulative Impacts. Motorized boats would continue to contribute to cumulative pollutants, although PWC contribution to cumulative emissions within the national recreation area would be eliminated. Cumulative impacts to human health from boating emissions in 2002 would range from negligible for PM_{10} and NO_x, to moderate for CO and HC (see table 28), and would be reduced relative to the other alternatives due to the beneficial impacts from elimination of PWC use in NPS-managed waters. Adverse impacts in 2012 would be the same as in 2002, except the impact of NO_x would increase from negligible to minor. Emissions of CO and NO_x would increase between 2002 and 2012 as a result of the production and availability of cleaner engines and increased boating activity, as described for alternative A. Even with the projected 1% increase in boating activity, HC emissions in 2012 would be less than in 2002 because of the continuing introduction of cleaner engines. Overall impact to regional ozone levels in 2012 would be beneficial, as described for alternative A. Impacts resulting from cumulative watercraft emissions on tribal-managed waters would be similar to cumulative impacts to NPS-managed areas, but with the addition of PWC use that would continue in tribal managed waters (table 29).

TABLE 28: MOTORIZED BOAT EMISSIONS AND HUMAN HEALTH IMPACT LEVELS AT LAKE ROOSEVELT NATIONAL RECREATION AREA – NO-ACTION ALTERNATIVE

	CO		PM_{10}		HC		NO_x	
	2002	2012	2002	2012	2002	2012	2002	2012
Annual Emissions (tons/year)	1488	1732	19	15	316	195	43	56
Impact Level	Moderate	Moderate	Negligible	Negligible	Moderate	Moderate	Negligible	Minor

TABLE 29: PWC EMISSIONS AND HUMAN HEALTH IMPACT LEVELS FOR TRIBAL MANAGED AREAS OF LAKE ROOSEVELT – NO-ACTION ALTERNATIVE

	CO		PM_{10}		HC		NO_x	
	2002	2012	2002	2012	2002	2012	2002	2012
Annual Emissions (tons/year)	38	33	0.9	0.7	19	11	0.1	0.4
Impact Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Conclusion. PWC use would not be reinstated within the national recreation area, resulting in long term, beneficial impacts in localized areas due to the elimination of CO, PM_{10}, HC, and NO_x emissions from personal watercraft.

PWC contribution to cumulative air quality impacts on NPS-managed waters would also be eliminated. Cumulative impacts to human health from the remaining motorized boats operating in NPS waters would be negligible for PM_{10} and NO_x and moderate for CO and HC in 2002. In 2012, impacts would be the same except for an increase in the impact of NO_X to minor levels due to cleaner engines and increased boating activity. These cumulative emissions would be reduced relative to other alternatives due to the elimination of PWC within the national recreation area, although some of this use would be displaced to tribal waters. Cumulative impacts to tribal managed areas would continue to include impacts from PWC use. Cumulative impacts from other motorized boats would be the same in tribal managed areas as in areas under NPS jurisdiction. All impacts would be long term.

Implementation of this alternative would not result in an impairment of air quality.

IMPACT TO AIR QUALITY RELATED VALUES FROM PWC POLLUTANTS

Environmental resources and values including visibility and biological resources (specifically ozone effects on plants) may be affected by airborne pollutants including O_3, NO_x, HC emitted from personal watercraft and other sources. $PM_{2.5}$ and NO_x emissions are evaluated for visibility impairment. HC and NO_x are precursors to the formation of ozone and are evaluated in lieu of ozone emissions.

To assess the impact of ozone on plants, the 5-year ozone index value, called SUM06 was calculated. The Air Resources Division of the National Park Service, based on local monitoring site data, developed SUM06 values used in this analysis.

To assess a level of impact on air quality related values from airborne pollutants, both the emissions of each pollutant related to motorized watercraft activity and the background air quality must be evaluated and then considered according to the thresholds defined below.

	Activity Analyzed		**Current Air Quality**
Negligible:	Emissions would be less than 50 tons/year for each pollutant.	**and**	There are no perceptible visibility impacts (photos or anecdotal evidence). **and** There is no observed ozone injury on plants. **and** SUM06 ozone is less than 12 ppm-hr.

Minor:	Emissions would be less than 100 tons/year for each pollutant.	**and**	SUM06 ozone is less than 15 ppm-hr.
Moderate:	Emissions would be greater than 100 tons/year for any pollutant.	**or**	Ozone injury symptoms are identifiable on plants.
	or		**and**
	Visibility impacts from cumulative PWC emissions would be likely (based on past visual observations).		SUM06 ozone is less than 25 ppm-hr.
Major:	Emissions would be equal to or greater than 250 tons/year for any pollutant.	**and**	Ozone injury symptoms are identifiable on plants.
	or		**or**
	Visibility impacts from cumulative PWC emissions would be likely (based on modeling or monitoring).		SUM06 ozone is greater than 25 ppm-hr.

Impairment: Air quality related values in the park would be adversely affected. In addition, impacts would:

- Have a major adverse effect on park resources and values; and
- Contribute to deterioration of the park's air quality to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation; or
- Affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or
- Affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

According to the NPS SUM06 ozone index maps for year 2000 based on rural monitoring sites, the ozone level for the recreation area is 0–6 ppm-hr.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use on NPS-managed waters of Lake Roosevelt would be reinstated according to management strategies in place prior to closure. There would be no locational restrictions or changes in speed limits from those previously enforced. As outlined in the "PWC and Boating Use Trends" section, annual use was estimated to be 4,486 personal watercraft in 2002, increasing at approximately 1% annually to 4,955 personal watercraft in 2012. During an average trip, PWC are assumed to operate on waters managed by both NPS and tribal entities, regardless of launch point.

Table 30 presents the annual PWC emissions, SUM06 data, and qualitative assessment of visibility and ozone-related effects for 2002 and 2012 under this alternative. Emissions of each pollutant would be less than 50 tons/year in both 2002 and 2012. The SUM06 ozone data show ozone levels to be in the range of 0 to 6 ppm-hrs, which indicates a negligible regional impact. Therefore, the adverse impact of PWC operation within the national recreation area on air quality related values from PWC pollutants would be negligible.

TABLE 30: AIR QUALITY RELATED IMPACTS FROM PWC EMISSIONS AT LAKE ROOSEVELT NATIONAL RECREATION AREA – ALTERNATIVE A

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2002	2012	2002	2012	2002	2012	2002	2012	2002	2012
40	22	0.2	0.8	1.7	1.3	No perceptible visibility impacts	No perceptible visibility impacts	Negligible	Negligible
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		No park specific effects documented		No park specific effects anticipated		0-6 ppm-hrs (rural monitoring)	0-6 ppm-hrs (rural monitoring) Assumed to be no greater than in 2002		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data.

Cumulative Impacts. The cumulative impact analysis includes other motorized watercraft use, taking into consideration regional use trends, as well as current and future emission levels. Cumulative emissions and impacts of all personal watercraft and other boating activities under alternative A are shown in table 31.

NO_x and $PM_{2.5}$ emissions would be less than 50 tons/year in 2002, and HC emissions would be 356 tons. As described above, SUM06 ozone values for the region are in the range of 0 to 6 ppm-hours. The SUM06 values are low and there are no documented ozone effects in the park. Therefore, it is presumed that the HC contribution to ozone-related air quality values would be minor. However, the HC emissions exceed 100 tons per year and the overall cumulative adverse impact in 2002 to air quality related values is classified as moderate. In 2012, NO_x emissions would increase above 50 tons per year, but there would be a much greater reduction in HC emissions, resulting in a beneficial contribution to ozone levels. Predicted year 2012 regional SUM06 ozone levels would be in the same range as year 2002. The cumulative adverse impacts to air quality related values within the national recreation area in 2012 would continue to be moderate. Cumulative impacts would also be applicable to tribal managed areas.

Conclusion. Negligible long-term adverse impacts to air quality related values would occur from personal watercraft operating on NPS-managed waters in 2002 and 2012. This conclusion is based on pollutant emissions of less than 50 tons per year, no observed visibility impacts or ozone-related plant injury, and low regional SUM06 values. Cumulative emissions from motorized boats and personal watercraft in both 2002 and 2012 would result in moderate adverse impacts to air quality related values. Although HC emissions would exceed 100 tons per year in 2002 and 2012, and NO_x emissions would exceed 50 tons per year in 2012, these emissions are representative of historic values and have not contributed to elevated SUM06 levels or observed visibility impacts or ozone-related plant injury. There would be beneficial effects to ozone levels in 2012 resulting from the expected reduction in HC emissions from new engine technology. Cumulative impacts would also be applicable to tribal managed areas.

Implementation of this alternative would not result in an impairment of air quality related values.

TABLE 31: CUMULATIVE AIR QUALITY RELATED IMPACTS FROM PWC AND OTHER MOTORIZED BOAT EMISSIONS AT LAKE ROOSEVELT NATIONAL RECREATION AREA – ALTERNATIVE A

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2002	2012	2002	2012	2002	2012	2002	2012	2002	2012
356	217	43	56	19	15	No perceptible visibility impacts	No perceptible visibility impacts	Moderate	Moderate
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		No park specific effects documented		No park specific effects anticipated		0-6 ppm-hrs (rural monitoring)	0-6 ppm-hrs (rural monitoring) Assumed to be no greater than in 2002		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Additional management prescriptions in alternative B including flat-wake restrictions would not affect PWC use numbers and potential future increases. Therefore, the predicted emission levels and impacts of continued PWC use to air quality related values in the national recreation area would be negligible as described for alternative A based on annual emission rates.

Cumulative Impacts. Cumulative adverse impacts from personal watercraft and other motorized boats within the national recreation area to air quality related values in both 2002 and 2012 would be moderate as described under alternative A. Emissions of $PM_{2.5}$ and SUM06 ozone values would be within the minor range for both 2002 and 2012. NO_x would increase to above 50 tons/ year in 2012; HC levels would be moderate for both years. Cumulative impacts would also be applicable to tribal managed areas.

Conclusion. The impacts of alternative B would be the same as alternative A. Alternative B would have long-term negligible adverse impacts to air quality related values from personal watercraft and moderate adverse impacts from cumulative emissions from motorized boats and personal watercraft in both 2002 and 2012. This conclusion is based on calculated levels of pollutant emissions. There are no observed visibility impacts or ozone-related plant injury in the recreation area. Cumulative impacts would also be applicable to tribal managed areas.

Implementation of this alternative would not result in an impairment of air quality related values.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative, PWC use within NPS-managed waters of Lake Roosevelt would not be reinstated resulting in the elimination of PWC emissions and their impacts on air quality related values within the national recreation area. PWC activity would continue in the waters under jurisdiction of the adjacent tribal entities, and some displacement of PWC to tribal launch facilities and waters would occur. Unlike the other alternatives, PWC use would be restricted to portions of the reservoir under the administration of the Spokane Tribe of Indians and the Confederated Tribes of the Colville Reservation.

Cumulative Impacts. The contribution from PWC operation within the national recreation area to cumulative impacts to air quality values would be eliminated. Other motorized watercraft would operate at the use levels described in the "PWC and Boating Use Trends" section and the area would continue to be influenced by other sources of $PM_{2.5}$ and ozone.

Cumulative impacts to air quality related values resulting from motorized boats are shown in table 32. Overall emissions would be reduced due to the elimination of PWC use on NPS waters. Cumulative adverse impacts to air quality related values would be moderate as in alternatives A and B due to levels of pollutant emissions, which would be greater than 50 tons per year in 2002 and 2012.

Total cumulative impacts to air quality related values from activities on the entire reservoir would be similar to those in NPS-managed areas, but would also include PWC use that would continue on tribal managed waters as described in the "PWC and Boating Use Trends" section. Table 33 presents the annual PWC emissions, SUM06 data, and qualitative assessment of visibility and ozone-related effects for 2002 and 2012 that could result from PWC use under the no- action alternative. Emissions of each pollutant would be less than 50 tons/year in both 2002 and 2012. The SUM06 ozone data show ozone to be in the range of 0 to 6 ppm-hrs indicating a negligible regional impact. Therefore, adverse impacts of PWC operation on air quality related values of both NPS- and tribal-managed areas would be negligible.

TABLE 32: AIR QUALITY RELATED IMPACTS FROM MOTORIZED BOAT EMISSIONS AT LAKE ROOSEVELT NATIONAL RECREATION AREA – NO-ACTION ALTERNATIVE

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2002	2012	2002	2012	2002	2012	2002	2012	2002	2012
316	195	43	56	17	14	No perceptible visibility impacts	No perceptible visibility impacts	Moderate	Moderate
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		No park specific effects documented		No park specific effects anticipated		0-6 ppm-hrs (rural monitoring)	0-6 ppm-hrs (rural monitoring) Assumed to be no greater than in 2002		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data.

TABLE 33: AIR QUALITY RELATED IMPACTS FROM PWC EMISSIONS IN TRIBAL MANAGED AREAS AT LAKE ROOSEVELT – NO-ACTION ALTERNATIVE

Emissions (tons/year)						Visibility Observations and Forecast		Impact Level	
HC		NO_x		$PM_{2.5}$					
2002	2012	2002	2012	2002	2012	2002	2012	2002	2012
19	11	0.1	0.4	0.8	0.6	No perceptible visibility impacts	No perceptible visibility impacts	Negligible	Negligible
Local Ozone Effects						SUM06 Index Value			
Ozone injury to plants (injury symptoms and monitoring data)		No park specific effects documented		No park specific effects anticipated		0-6 ppm-hrs (rural monitoring)	0-6 ppm-hrs (rural monitoring) Assumed to be no greater than in 2002		

Source for SUM06 values: NPS Air Quality Division year 2000 monitoring data.

Conclusion. Emissions from PWC use within the national recreation area and their contribution to impacts on air quality related values would be eliminated. Cumulative adverse impacts to air quality related values from other motorized boat use would be moderate and long-term and would apply to both NPS- and tribal-managed areas. Continued PWC use on tribal managed waters would also contribute negligible impacts to overall cumulative impacts for both NPS- and tribal-managed areas. This conclusion is based on regional SUM06 values, the lack of existing or anticipated local ozone or visibility effects, and the calculated pollutant emission levels.

Implementation of this alternative would not result in an impairment of air quality related values.

SOUNDSCAPES

The primary soundscape issue relative to PWC use is that other visitors may perceive the sound made by personal watercraft as an intrusion or nuisance, thereby disrupting their experiences. This disruption is generally short term because personal watercraft travel along the shore to outlying areas. However, as PWC use increases and concentrates at beach areas, related noise becomes more of an issue, particularly during certain times of the day. Additionally, visitor sensitivity to PWC noise varies from fisherman (more sensitive) to swimmers at popular beaches (less sensitive).

GUIDING REGULATIONS AND POLICIES

The national park system includes some of the quietest places on earth as well as a rich variety of sounds intrinsic to park environments. These intrinsic sounds are recognized and valued as a park resource in keeping with the NPS mission (*Management Policies 2001,* sec. 1.4.6), and are referred to as the park's natural soundscape. The natural soundscape, sometimes called natural quiet, is the aggregate of all the natural sounds that occur in parks, absent human-caused sound, together with the physical capacity for transmitting the natural sounds (*Management Policies 2001,* sec. 4.9). It includes all of the sounds of nature, including such "non-quiet" sounds as birds calling, waterfalls, thunder, and waves breaking against the shore. Some natural sounds are also part of the biological or other physical resource components of parks (e.g., animal communication, sounds produced by physical processes such as wind in trees, thunder, running water).

NPS policy requires the restoration of degraded soundscapes to the natural condition whenever possible, and the protection of natural soundscapes from degradation due to noise (undesirable human-caused sound) (*Management Policies 2001,* sec. 4.9). The National Park Service is specifically directed to "take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored" (*Management Policies 2001,* sec. 4.9). Overriding all of this is the fundamental purpose of the national park system, established in law (e.g., 16 USC 1 et seq.), which is to conserve park resources and values (*Management Policies 2001*. sec. 1.4.3). NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values (*Management Policies 2001,* sec 1.4.3).

Noise can adversely affect park resources, by modifying or intruding upon the natural soundscape. For example, Noise can indirectly impact wildlife resources by interfering with sounds important for animal communication, navigation, mating, nurturing, predation, and foraging functions. Noise impacts to non-human species are discussed in the "Wildlife and Wildlife Habitat" and "Threatened, Endangered, and Special Concern Species" sections of this EA.

Noise can also adversely impact park visitor experiences. The term "visitor experience" can be defined as the opportunity for visitors to experience a park's resources and values in a manner appropriate to the park's purpose and significance, and appropriate to the resource protection goals for a specific area or management zone within that park. In other words, visitor experience is primarily a resource-based opportunity appropriate to a given park or area within a park, rather than a visitor-based desire. Noise impacts to visitor experience can be especially adverse when management objectives for visitor experience include solitude, serenity, tranquility, contemplation, or a completely natural or historical environment. Management objectives for resource protection and visitor experience are derived through well-established public planning processes from law, policy, regulations, and management direction applicable to the entire national park system and to each specific park unit.

Visitor uses of parks will only be allowed if they are appropriate to the purpose for which a park was established, and if they can be sustained without causing unacceptable impacts to park resources or values (*Management Policies 2001,* sec. 8.1 and 8.2). While the fundamental purpose of all parks also includes providing for the "enjoyment" of park resources and values by the people of the United States, enjoyment can only be provided in ways that leave the resources and values unimpaired for the enjoyment of future generations (*Management Policies 2001,* sec. 1.4.3). Unless mandated by statute, the National Park Service will not allow visitors to conduct activities that unreasonably interfere with "the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park" (*Management Policies 2001,* sec. 8.2). While many visitor activities are allowed or even encouraged in parks consistent with the above policies, virtually all visitor activities are limited or restricted in some way (e.g., through carrying capacity determinations, implementation plans, or visitor use management plans), and on a park or area specific basis, some visitor activities are not allowed at all.

The degree to which a given activity (e.g., PWC use) is consistent with, or moves the condition of a resource or a visitor experience toward or away from a desired condition, is one measure of the impact of the activity.

The federal regulation pertaining to noise abatement for boating and water use activities (current draft of 36 CFR 3.7) prohibits operating a vessel on inland waters "so as to exceed a noise level of 82 decibels measured at a distance of 82 feet (25 meters) from the vessel" and specifies that testing procedures to determine such noise levels should be in accordance with or exceed those established by the Society of Automotive Engineers (SAE) in "Exterior Sound Level Measurement Procedure for Pleasure Motorboats" (J34). This SAE procedure specifies that sound level measurements be taken 25 meters perpendicular to the line of travel of the vessel at full throttle (SAE 2001). It is important to note that this NPS regulation and the SAE procedure were developed for enforcement purposes, not impact assessment purposes. The noise level in the regulation does not imply that there are no impacts to park resources or visitor experiences when watercraft noise is within the regulatory limits; it just indicates that noise levels from vessels legally operating on NPS-managed waters will be no "louder" than 82 dBA at 25 meters distance. A single decibel value does not provide much information for impact assessment purposes.

Moreover, the State of Washington has adopted legislation that regulates PWC operation. Washington state PWC regulations that may have impacts on recreation area soundscapes include timing restrictions. Personal watercraft cannot be operated from sunset to sunrise (WSP 2002).

METHODOLOGY AND ASSUMPTIONS

The methodology used to assess PWC-related noise impacts in this document is consistent with NPS *Management Policies 2001, Director's Order #47: Soundscape Preservation and Noise Management,* and

the methodology being developed for the reference manual for *Director's Order #47* (NPS 2000b). Specific factors at Lake Roosevelt National Recreation Area related to context, time, and intensity are discussed below and are then integrated into a discussion of the impact thresholds used in this analysis.

Context: Existing noise levels at Lake Roosevelt are influenced by visitor activities, watercraft, automobiles, lumber operations, aircraft, and wind. Noise influences and levels differ over the 130-mile span of Lake Roosevelt within the recreation area. A variety of watercraft are used on the lake in the summer season, e.g., ski boats, personal watercraft, runabouts, day cruisers, sailboats, houseboats, canoes, kayaks, and rowboats. Due to the easy access of marinas and boat launches, watercraft are most heavily used in the Two Rivers and Porcupine Bay areas, and also at Spring Canyon and Kettle Falls. PWC users tend to focus their water activity near their launch site. Natural sounds are evident in low use areas throughout the park; however, there are no areas where watercraft are not allowed on Lake Roosevelt itself, although they are prohibited on Crescent Bay Lake.

Time Factors: *Time Periods of Interest* —PWC use at Lake Roosevelt National Recreation Area occurs from April through November, with primary use from June through September. During the PWC use period, personal watercraft make up approximately 4% of the total number of watercraft on the lake. On a daily basis, peak use occurs during mid-day. Use generally stops during periods of inclement weather (e.g., cold and thunderstorms).

Time periods of greater sensitivity to noise impacts include sunset, sunrise, and night time when visitors may be in camp, and when wildlife may be more active.

Duration and Frequency of Occurrence of Noise Impacts — In areas of concentrated PWC use, noise from personal watercraft (and other boat types) can be present intermittently from early morning to sunset. In areas of lower use, noise from personal watercraft (and other boat types) can be occasional, usually lasting a few minutes. An average of 56 personal watercraft are used on Lake Roosevelt on peak holidays such as the Fourth of July. On a typical summer day, approximately 37 personal watercraft are used.

Intensity: PWC-generated noise varies from vessel to vessel. The National Park Service contracted for noise measurements of personal watercraft and other motorized vessels in 2001 at Glen Canyon National Recreation Area (Harris Miller Miller & Hanson, Inc. 2002). The results show that maximum PWC noise levels at 25 meters (82 feet) ranged between 68 to 76 decibels on the A-weighted scale. Noise levels for other motorboat types of similar horsepower to the personal watercraft measured during that study ranged from 65 to 77 dBA at 25 meters (82 feet). The larger boats, characterized as "V8 'muscle' boats," had noise levels of 85 to 86 dBA at 25 meters (82 feet). Visitors 100 feet from a personal watercraft may be exposed to noise levels of approximately 66 to 74 dBA. The severity of impact may also be affected by variations in noise levels that result from rapid changes in acceleration or direction.

Context, time, and intensity together determine the level of impact for an activity. For example, noise for a certain period and intensity would be a greater impact in a highly sensitive context, and a given intensity would be a greater impact if it occurred more often, or for longer duration. It is usually necessary to evaluate all three factors together to determine the level of noise impact. In some cases an analysis of one or more factors may indicate one impact level, while an analysis of another factor may indicate a different impact level, according to the criteria below. In such cases, best professional judgment based on a documented rationale must be used to determine which impact level best applies to the situation being evaluated.

PWC noise travels in relationship to the speed of the craft, the distance from shoreline, and other influences. To estimate the relative impacts of PWC use, the following methodology was applied:

1. Data from the 2001 watercraft noise study at Glen Canyon National Recreation Area was used to estimate the average decibel levels of personal watercraft.

2. Areas of shoreline use by other visitors were identified in relation to where personal watercraft launch and operate offshore. Personal observation from park staff were used to identify these areas, as well as determine the number of personal watercraft and timeframes of use.

3. Other considerations, such as topography and prevailing winds, were then used to identify areas where PWC noise levels could be exacerbated or minimized.

Sound levels generated by motorized craft using the recreation area are expected to affect recreational users differently. For example, visitors participating in less sound-intrusive activities such as camping would likely be more adversely affected by PWC noise than another PWC or motorboat user. Therefore, impacts to soundscape must take into account the effect of noise levels on different types of recreational users within the impact analysis area. The following is a list of other considerations for evaluating sound impacts:

- The number of personal watercraft per day on a typical summer day by district in the national recreation area was assumed from table 12 presented in the "PWC and Boating Use Trends" section.

- Personal watercraft commonly operate farther than 150 feet from the shoreline; the farther from shore, the lower the noise level to shoreline visitors.

- Noise levels within flat-wake zones are less than at full throttle and occur for short durations.

- Ambient noise levels at most locations include wind, waves, automobiles, aircraft, other visitor activities, and other motorboats.

IMPACT ANALYSIS AREA

The impact analysis area for soundscapes is related to the area of PWC use and the distance that PWC noise travels. Personal watercraft are allowed to operate in locations on Lake Roosevelt as indicated on the alternatives maps, except Crescent Bay Lake. However, personal watercraft and other watercraft are speed restricted in sensitive areas. Such flat-wake or speed restricted areas include Hawk Creek from the waterfall at the campground to an area called "the narrows" and Kettle River above Napoleon Bridge as well as 100 feet around swim beaches, marinas, and narrow sections of the lake.

External influences that provide relatively high ambient sound come from State Route 25, which is adjacent to the eastern shoreline of Lake Roosevelt and crosses the lake at Fort Spokane; U.S. 395 near Kettle Falls; lumber operations located above Kettle Falls; and Navy jet aircraft, which are unrestricted and fly over the lake once a day in the summer.

PWC noise is reduced over distance. Compared to the noise level at a distance of 50 feet, a reduction of approximately 34 dBA would be expected over a distance of 0.75 mile, with the noise from a single personal watercraft reduced to 34–42 dBA, which is a less than daytime ambient noise level anticipated in the more populated recreation areas. Noise levels would be greater with multiple watercraft. Thus, the

impact analysis area for soundscapes will be taken as the lake area, shoreline, and the 0.75-mile inland shore area within the national recreation area, except where noted in the cumulative impact analysis.

IMPACT TO VISITORS FROM NOISE GENERATED BY PERSONAL WATERCRAFT

After estimating the number of personal watercraft, the range of relative noise generated by personal watercraft, and the potential areas where noise concentrations and effects on other visitors may be of concern, the following thresholds were used as indicators of the magnitude of impact for each of the PWC management alternatives:

Negligible: Natural sounds would prevail; motorized noise would be very infrequent or absent, mostly immeasurable.

Minor: Natural sounds would predominate in areas where management objectives call for natural processes to predominate, with motorized noise infrequent at low levels. In areas where motorized noise is consistent with park purpose and objectives, motorized noise could be heard frequently throughout the day at moderate levels, or infrequently at higher levels, and natural sounds could be heard occasionally.

Moderate: In areas where management objectives call for natural processes to predominate, natural sounds would predominate, but motorized noise could occasionally be present at low to moderate levels. In areas where motorized noise is consistent with park purpose and objectives, motorized noise would predominate during daylight hours and would not be overly disruptive to noise-sensitive visitor activities in the area; in such areas, natural sounds could still be heard occasionally.

Major: In areas where management objectives call for natural processes to predominate, natural sounds would be impacted by human noise sources frequently or for extended periods of time at moderate intensity levels (but no more than occasionally at high levels), and in a minority of the area. In areas where motorized noise is consistent with park purpose and zoning, the natural soundscape would be impacted most of the day by motorized noise at low to moderate intensity levels, or more than occasionally at high levels; motorized noise would disrupt conversation for long periods of time and/or make enjoyment of other activities in the area difficult; natural sounds would rarely be heard during the day.

Impairment: The level of noise associated with PWC use would be heard consistently and would be readily perceived by other visitors throughout the day, especially in areas where such noise would potentially conflict with the intended use of that area. In addition, these adverse, major impacts to park resources and values would contribute to deterioration of the park's soundscape to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation; affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Under alternative A, PWC use would be reinstated in NPS-managed waters of Lake Roosevelt, as it was managed prior to closure to personal watercraft in November 2002. As shown in table 18, PWC use levels at Spring Canyon, Fort Spokane, and Kettle Falls districts would range from 20 to 22, 24 to 27, and 12 to 13 craft per day, respectively, during the typical peak use season over the next 10 years. The distribution and regulation of personal watercraft under this alternative would continue the same pattern of use that existed prior to closure. PWC use would be allowed within the entire recreation area with the exception of Crescent Bay Lake. Flat-wake restrictions would be in place on upper portions of the Kettle River and Hawk Creek. Due to the large size of the Lake Roosevelt, PWC users generally distribute themselves throughout the reservoir, with PWC activity higher near the launch areas and shoreline use areas.

PWC use patterns in the park are characterized by several people per personal watercraft who take turns riding. A personal watercraft will return to the area where a group is picnicking/camping to rest or switch riders. From park observations, personal watercraft generally run at higher speeds (and higher noise levels) after they have left the launch or picnic/camping areas and have gotten out into open water. Personal watercraft are restricted to minimum speeds necessary to maintain steerageways within 100 feet of marked swimming or boat access areas. There are picnic and other shoreline use areas where personal watercraft can operate closer to shore, if no swimmers are present. Users at the picnic areas or swimming areas at those locations are exposed to PWC noise as they come in and out of the shore area if allowed, and from noise of several personal watercraft that may be operating at high speeds in the vicinity. The impact from a personal watercraft coming into the shore area is dependent on the distance from shore that the operator slows down and at what speed they approach the shoreline. One personal watercraft operating at 50 feet from shore at 40 mph would generate noise levels of approximately 78 dBA to a shoreline observer; at 20 mph, the noise level would be approximately 73 dBA. At a distance of 100 feet, the noise level would be approximately 6 dBA less than at a distance of 50 feet. The noise level from two identical watercraft would be 3 dBA higher than from a single vessel. With new designs of personal watercraft, engines may be quieter in the future.

Overall, noise from personal watercraft would be expected to have short-term, minor to moderate adverse impacts at certain locations along the lake on days of heavy PWC use. Minor adverse impacts would occur where use is infrequent and distanced from other park users, for example, as PWC users operated far from shore. Even with more frequent or constant PWC use, adverse impacts would be minor where the use occurs in an area where motorized watercraft use is consistent with park objectives and existing watercraft facilities, such as Porcupine Bay, Fort Spokane and Spring Canyon. Moderate adverse impacts would occur from highly concentrated PWC use in one area, as on the highest PWC use days of the year, such as a Saturday on the Fourth of July holiday weekend. Although noise levels may be bothersome for some, most visitors to Lake Roosevelt National Recreation Area on a busy holiday weekend would expect to hear motorized noises, and PWC and other motorized watercraft use is consistent with park purpose of supplying visitors with water-based recreational opportunities. Moderate adverse impacts might also occur if PWC users choose to operate in areas of the park that are away from launch areas and campgrounds, and where shoreline visitors would be anticipating a quiet, wilderness experience.

Cumulative Impacts. Other noise sources in Lake Roosevelt National Recreation Area include natural sounds such as waves or wind, automobiles on State Route 25, aircraft, lumber operations, other boats, and other visitor activities. Boating activities in the lake are capable of generating noise levels higher than personal watercraft due to the number of watercraft, (96% of total motorized watercraft use), their area of operation, and noise characteristics of motorboats, which operate at similar and higher noise levels than personal watercraft. Although many motorboats can generate higher sound levels than personal

watercraft, most are generally not perceived to be as annoying due to their more typical steady rate of speed and direction. However, at Lake Roosevelt, the high-powered speedboats (muscle boats, "cigarette boats,") may have noise levels that are higher than other watercraft, and have generated the most noise complaints.

Cumulative adverse impacts on the Lake Roosevelt National Recreation Area soundscape from personal watercraft, boating, and other noise sources would be predominately moderate. The cumulative impacts from all vessels would be more severe than from personal watercraft alone because there are more than 20 times the total watercraft than personal watercraft. In areas where management objectives call for natural processes to predominate, impacts may be minor only in the winter months, with moderate impacts during the remainder of the year. In areas where motorized watercraft noise is consistent with park purpose and objectives, motorized watercraft noise would predominate during daylight hours, with occasional occurrences at high levels from high-horsepower boats. Natural sound would be rarely heard during the day in these areas. It is not anticipated that the noise would be so much as to make enjoyment of other activities difficult. Impacts would generally be long-term because of the volume of boating use distributed throughout much of the year and because the use reoccurs annually.

Other visitors would also contribute to the soundscape, including beach users, picnickers, and campers. However, these sounds are considered more acceptable and compatible with typical uses within the national recreation area. Non-watercraft related visitor noise would have a negligible adverse impact on the soundscape at Lake Roosevelt National Recreation Area. Impacts would be short term, since noise would usually be present for limited duration. Cumulative impacts to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas.

Conclusion. Noise from personal watercraft would have short-term minor to moderate adverse impacts at most locations at Lake Roosevelt National Recreation Area and the immediate surrounding area. Impacts would be related to the number of personal watercraft operating as well as the sensitivity of other visitors, and would be highest during summer weekends and holiday periods during periods of peak use.

Cumulative adverse noise impacts from personal watercraft and other watercraft, automobiles, aircraft, and lumber operations would be minor to moderate, and would predominate on busy days during the high use season. Impacts would be long-term because of the high volume of annual boating use. Cumulative impacts to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas. Non-watercraft visitor use would have a negligible adverse impact on the soundscape at Lake Roosevelt.

Implementation of this alternative would not result in an impairment of the park's soundscape.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be reinstated with additional management strategies to mitigate watercraft safety concerns and to enhance overall visitor experience.

PWC use would follow the same patterns as in alternative A; however, alternative B would result in a reduction in noise levels from personal watercraft to park visitors, including fisherman and near shoreline users of the swimming, picnic, and camping areas, as flat-wake speed would be implemented in these areas, resulting in beneficial impacts. The magnitude of noise reduction near the speed restriction areas would be dependent on the changes in location and speed. As described in the analysis for alternative A, a reduction from 40 mph to 20 mph would reduce PWC noise levels approximately 5 dBA. Negligible

noise reductions would occur with reductions in speed limits below 20 mph. Increasing the distance from the personal watercraft to the listener from 100 to 200 feet, would result in a noise reduction of about 6 dBA.

The types and levels of adverse impacts to the soundscape of other parts of Lake Roosevelt National Recreation Area would be generally the same as for alternative A, including the minor adverse impacts when PWC use is occasional and distanced from other park users, and moderate adverse impacts from concentrated PWC use in one area. Overall, minor to moderate adverse impacts would result from PWC use on the soundscape of the recreation area. Impacts would generally be short-term, although they could periodically be more consistent and bothersome at shoreline areas on the very high use days, where motorized watercraft noise may predominate off and on for most of the day. Most visitors to Lake Roosevelt National Recreation Area during those high use periods expect to hear motorized craft during the day, as the lake is known by the mostly local and regional users for providing this type of recreational opportunity, in addition to other activities.

Cumulative Impacts. Non-PWC sounds in Lake Roosevelt National Recreation Area include natural sources such as waves or wind, other watercraft, automobiles on SR 25, aircraft, lumber operations, and other visitor activities. Cumulative impacts on the Lake Roosevelt soundscape and overall threshold levels would be similar to those of alternative A for both NPS- and tribal-managed areas, and would cause minor to moderate adverse impacts. The reduction in noise from personal watercraft that would result from the alternative B flat-wake restrictions within the national recreation area would likely have negligible effects on reducing cumulative noise levels in areas of mixed boating use.

Conclusion. Noise from personal watercraft would have minor to moderate adverse impacts at most locations at Lake Roosevelt National Recreation Area and the immediate surrounding area. Impact levels would relate to the number of personal watercraft operating as well as the sensitivity of other visitors. Flat-wake restrictions would have beneficial impacts to some park visitors from reduced noise levels. Cumulative adverse noise impacts from personal watercraft and other watercraft, automobiles on SR 25, aircraft, lumber operations, and other visitor activities would be minor to moderate because these sounds would be heard occasionally throughout the day, and may predominate on busy days during the high use season. Cumulative impacts to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas.

Implementation of this alternative would not result in an impairment of the park's soundscape.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under this alternative, PWC use would continue to be banned from operating within NPS-managed waters of Lake Roosevelt. There would be no noise generated by PWC launching and operating in the park areas to impact fisherman, campers, and other park visitors near the NPS launch areas. Some PWC operators that previously used NPS launch facilities would be displaced to tribal launch facilities and PWC would only operate on tribal waters.

Cumulative Impacts. Cumulative adverse impacts to the national recreation area soundscape would be long-term minor to moderate and would include motorized boating activities that would continue to create noise impacts throughout the day and in many locations of the lake. PWC use is estimated to be approximately 4% of summertime motorized watercraft use and the elimination of personal watercraft would have a small, but not substantial effect on the level of noise present on and near the lake. PWC use would continue outside the boundaries of the national recreation area in the waters of Lake Roosevelt

under the jurisdictions of the Colville Confederated Tribes and Spokane Tribe of Indians reservations. Therefore, minor adverse effects could occur in the recreation area from PWC operation outside park boundaries. These impacts would result from the close proximity of PWC use that would continue in non-NPS-managed waters and the potential for some PWC users to inadvertently cross over into NPS-managed waters and facilities. Cumulative impacts from motorized boats to the soundscape at adjacent tribal managed visitor use areas would be similar to impacts in NPS-managed areas. Increased effects on the soundcape would occur due to PWC use in tribal managed areas relative to the soundscape at NPS-managed areas.

Other uses also contribute to the area's soundscape, including swimming, picnicking, and camping. However, these sounds are considered more acceptable and compatible with other uses. Non-boating related visitor noise would have a negligible adverse effect on the natural soundscape at the park.

Conclusion. Noise experienced at the national recreation area would be decreased in comparison to alternatives A and B due to the elimination of PWC use in NPS-managed waters. There would be occasionally noticeable beneficial effects on the soundscape of the areas of the park where personal watercraft have traditionally operated. Cumulative noise impacts including those from motorized boats and other visitor activities as well as personal watercraft on adjacent tribal managed waters would have a long-term, minor to moderate adverse impact on the soundscape of the park. Cumulative impacts on the tribal soundscape would be similar, but with a continued contribution from PWC use on tribal managed waters.

Implementation of this alternative would not result in an impairment of the park's soundscape.

WILDLIFE AND WILDLIFE HABITAT

Some research suggests that PWC use affects wildlife by causing interruption of normal activities, alarm or flight, avoidance or degradation of habitat, and effects on reproductive success. This is thought to be a result of a combination of PWC speed, noise and ability to access sensitive areas, especially in shallow-water depths.

Waterfowl and nesting birds are the most vulnerable to personal watercraft. Fleeing a disturbance created by personal watercraft may force birds to abandon eggs during crucial embryo development stages, prevent nest defense from predators, and contribute to stress and associated behavior changes.

Impacts to sensitive species, such as the bald eagle, are documented under "Threatened, Endangered, or Special Concern Species."

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities. According to NPS *Management Policies 2001,* the restoration of native species is a high priority (sec. 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals.

There are no additional federal, state, or local regulations or policies for wildlife and wildlife habitat at Lake Roosevelt National Recreation Area.

METHODOLOGY AND ASSUMPTIONS

Potential impacts to wildlife and wildlife habitat were evaluated based on the pattern of PWC use in Lake Roosevelt, the nature of habitats and species present, and the professional judgment of the project team and members of the park staff. Information on wildlife habitat was acquired from park staff, existing NPS reports, USFWS and Washington Department of Natural Resources, and other public information resources. To assess impacts from PWC use on wildlife within the national recreation area, the following assumptions were made:

1. The majority of PWC users operate their craft in a lawful manner.

2. Approximately 56 personal watercraft are on Lake Roosevelt during a peak summer day such as the 4th of July for an average of 3 hours per day.

3. Generally, impacts are expected to be similar or slightly greater in 2012 relative to 2002 due to the slight increase in PWC use at Lake Roosevelt of 1% per year. Approximately 62 personal watercraft would be on the water in 2012 on a peak use day.

4. PWC users who disembark on the shore would travel no more than 100 feet inland and would follow existing trails.

IMPACT ANALYSIS AREA

The focus of this study is the shoreline within the national recreation area. PWC noise may disturb wildlife along the shore, extending inland approximately 200 feet. This 200-foot inland area is assumed to provide an encompassing range of assessment based on the distance of PWC operation from the shoreline and wildlife responses to PWC activity. It is acknowledged that effects to wildlife and habitat in areas under jurisdiction of the Spokane and Colville Confederated Tribes would be similar to those in the NPS study area. However, except where stated, the focus of this analysis includes portions of the reservoir and shoreline under NPS jurisdiction.

IMPACT OF PWC USE AND NOISE ON WILDLIFE AND HABITAT

The following thresholds were used to determine the magnitude of effects on wildlife and wildlife habitat:

Negligible: No wildlife species are present; no impacts or impacts with only temporary effects are expected.

Minor: Non-breeding animals are present, but only in low numbers. Habitat is not critical for survival; other habitat is available nearby. Occasional flight responses by wildlife are expected, but without interference with feeding, reproduction, or other activities necessary for survival.

Moderate: Breeding animals are present; animals are present during particularly vulnerable life-stages such as migration or juvenile stages; mortality or interference with

activities necessary for survival are expected on an occasional basis, but are not expected to threaten the continued existence of the species in the park.

Major: Breeding animals are present in relatively high numbers, and/or wildlife are present during particularly vulnerable life stages. Habitat targeted by PWC use or other actions has a history of use by wildlife during critical periods and is somewhat limited. Mortality or other effects are expected on a regular basis and could threaten the continued survival of the species in the park.

Impairment: Some of the major impacts described above might be an impairment of park resources if their severity, duration, and timing resulted in the elimination of a native species or significant population declines in a native species. In addition, these adverse, major impacts to park resources and values would:

- Contribute to deterioration of the park's wildlife resources and values to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation;
- Affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or
- Affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use could affect wildlife wherever motorized vessels are allowed. Personal watercraft would be allowed to operate and launch at designated sites throughout the national recreation area. Restrictions that were in place prior to the PWC closure would be applicable and include restrictions on all watercraft in Crescent Bay Lake (prohibited), Hawk Creek (flat-wake restrictions), and the upper Kettle River (flat-wake restrictions). Due to low water and air temperatures throughout the majority of the year, primary PWC use occurs from June through September with peak use during July and August. PWC use levels are low relative to other recreation area activities, with approximately 56 PWC users on a peak use summer day in 2002, as noted in the "Methodology and Assumptions" section.

Within the impact analysis area, wildlife such as waterfowl are most likely to occur near the shoreline due to habitat constraints. Some species such as small mammals may visit the shoreline often, even though their primary habitat is outside of the immediate shoreline area. Other wildlife species that occur within the recreation area occur at the shoreline only infrequently. Primary habitat for many species is associated with tributary drainages or forested areas near the northern portions of the lake. There are no documented cases of deliberate harassment or collisions with wildlife by PWC users on Lake Roosevelt.

The following summarizes the impacts that would be expected from PWC use to the wildlife species and habitat discussed in the "Affected Environment" chapter. In some cases, species mentioned in the general wildlife description are not likely to occur in the limited area of water and shoreline that is within the study area and therefore are not included in the impact analysis.

Mammals – Impacts to mammals would be negligible to minor because most species rarely use the shoreline. Most are either transient visitors from inland parts of the recreation area or are generally

acclimated to human intrusion. Aquatic mammals such as beaver are mobile and can avoid noise and physical disturbance associated with PWC use. Their breeding areas are typically in backwater areas not frequented by personal watercraft and adverse impacts would be negligible. In addition, primary habitat areas for large mammals such as deer and elk are typically located further inland away from areas of PWC use. Negligible adverse impacts to these species would include potential disturbance from PWC noise. Small mammals common to the area such as marmots, skunks, porcupines, and chipmunks generally acclimate easily to human activity and have the ability to avoid impacts. Potential adverse impacts to these species include minor and short-term disturbances due to PWC noise.

Birds – Breeding habitat (aquatic and shoreline vegetation) for birds is lacking within areas utilized by personal watercraft at Lake Roosevelt National Recreation Area. Suitable habitat is located in the Hawk Creek and Kettle and Colville rivers, but these locations are protected by flat-wake designation or inaccessibility to personal watercraft. Flat-wake zones protect habitat by slowing personal watercraft to speeds that result in less noise disturbance and less erratic behavior. In addition, most personal watercraft are not used in the spring at Lake Roosevelt due to low water and air temperatures, further minimizing the potential for disturbance to breeding individuals. Waterfowl would be more susceptible to PWC use than other bird species, but any impacts would be short-term, and would likely constitute temporary disturbance to foraging or resting individuals through noise or physical disturbance. The potential exists for some impacts during brood rearing, but again is unlikely due to lack of suitable habitat in areas of high PWC use. Due to a lack of breeding or brood rearing habitat for waterfowl and other birds in areas of PWC use at the recreation area, adverse impacts to avian species associated habitat would be short-term negligible to minor.

Fish – Personal watercraft could potentially affect fish through pollutant loads and/or physical disturbance. As discussed in the "Water Quality" section, reinstated use of personal watercraft would create pollutant loads that are well below ecotoxicological benchmarks. Therefore, adverse impacts to fish related to water contamination by personal watercraft at Lake Roosevelt would be negligible. Impacts from pollution would decrease between 2002 and 2012, despite projected increases in PWC use, because overall pollutant loads would decrease as a result of marine engine conversions to cleaner engine technology per EPA industry standards.

The lack of shoreline aquatic vegetation and invertebrate populations in recreation area waters precludes the existence of concentrated shallow water feeding areas that would be susceptible to effects from personal watercraft. In general, fish avoid direct impact from personal watercraft. Adverse impacts from physical disturbance by PWC use to fish populations and spawning areas at Lake Roosevelt would be short-term, negligible to minor.

Amphibians and Reptiles – Impacts to reptiles and amphibians would be most likely to occur in locations where personal watercraft or their users disrupt nesting or breeding sites. Such sites are not known to be common in areas of high PWC use at the recreation area. Adverse impacts from PWC activity at Lake Roosevelt would be negligible and are expected to be short term.

Cumulative Impacts. Potential cumulative impacts to wildlife and wildlife habitat in the recreation area include various visitor activities, such as motorized boat operation, that occur in proximity to wildlife species. Visitors have access to the shoreline by many types of non-PWC watercraft, automobiles, and hiking. Non-PWC boating activities account for approximately 95% of total boating activity in the recreation area. Wildlife routinely exhibit movement or flight response due to disturbance by powerboats that is similar to response from PWC-caused disturbance (Rodgers and Schwikert 2002).

Interactions between wildlife and human visitors would be limited because of the low abundance of wildlife within the high use areas and the dispersion of visitors along the shoreline. Shoreline activities

tend to be concentrated around developed facilities, where habitat characteristics are lacking relative to undeveloped shoreline areas. Visitor interactions would not interfere with feeding, reproduction, or other activities necessary for the survival of wildlife species. Cumulatively, visitors engaging in multiple activities, including PWC use, would cause minor, short-term adverse impacts to wildlife that are dispersed over a large area along the shoreline.

Operations of the Grand Coulee Dam are implemented jointly by the Bureau of Reclamation and the U.S. Army Corps of Engineers. The Bonneville Power Administration sells the electricity generated by the dam. Fluctuation of lake levels for power production and management of the Columbia River contributes to cumulative effects on fish and wildlife habitat in the recreation area. Water retention times and lake levels in Lake Roosevelt affect fish through impacts on nutrient availability, zooplankton populations (food source for fish), and movement of fish past the dam (Underwood and Shields 1996). Wildlife habitat is also potentially affected when lake fluctuations affect water levels in tributary drainages that support wetland and riparian vegetation. Adverse impacts from lake operations to fish or wildlife habitat could be minor to moderate and long term. PWC use at current and future levels would not increase this impact.

Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas.

Conclusion. PWC use within NPS-managed areas at Lake Roosevelt would have negligible to minor adverse impacts on fish, waterfowl, and other wildlife. Due to low levels of PWC use in the recreation area, coupled with a lack of prime habitat areas at the shoreline, any impacts to fish, wildlife and respective habitats would be temporary and short term. The intensity and duration of impacts is not expected to increase substantially over the next 10 years, since PWC numbers would not increase substantially and engine technology would continue to improve under EPA industry regulations. Cumulative impacts from motorized boating and other visitor activities would have short-term, minor adverse effects on wildlife and wildlife habitat. Lake operations also contribute to cumulative impacts through fluctuations in water level and potentially would cause minor to moderate adverse impacts to fish, and beneficial or adverse impacts to riparian and wetland areas that provide habitat for wildlife. Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas.

Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would occur in the recreation area as under alternative A, except some additional management strategies would be implemented such as flat-wake restrictions around activity areas and along a small stretch of the Spokane Arm. The added flat-wake restrictions would be implemented in areas where visitor activities are currently high, precluding the existence of prime wildlife habitat. Therefore, these flat-wake restrictions would cause only beneficial impacts through a decrease in noise and disturbance by personal watercraft. In addition, a resource monitoring program would be established to assist in the detection and prevention of future impacts from PWC use. This would cause beneficial impacts to wildlife as future management strategies could be implemented based on data gathered during monitoring. Despite beneficial management strategies, adverse impacts to fish and wildlife from PWC use at Lake Roosevelt National Recreation Area would be negligible to minor, but would be less than under alternative A. All wildlife impacts would be temporary and short term.

Cumulative Impacts. The cumulative effects of alternative B would be the same as alternative A. Adverse impacts to wildlife and wildlife habitat from motorized boats and other visitor activities would be short-term and minor. Lake operations could cause long-term minor to moderate adverse cumulative impacts to fish and wildlife habitat through effects on water levels and retention times in the reservoir. Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas.

Conclusion. The reinstatement of PWC use with flat-wake restrictions and the establishment of a resource monitoring program would have beneficial impacts to wildlife due to the decreased noise and disturbance from personal watercraft and the ability to mitigate future impacts. Despite these benefits, impacts to wildlife and wildlife habitat would be adverse negligible to minor in 2002 and 2012, similar to alternative A. All wildlife impacts from personal watercraft would be temporary and short term. Cumulative adverse impacts from motorized boats and other visitor activities would be negligible to minor as under alternative A. Lake operations would also contribute to cumulative adverse impacts through minor to moderate levels of long-term habitat disturbance. Cumulative impacts to tribal managed wildlife resources would be similar to those described above for NPS-managed areas.

Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative, PWC use would not be reinstated on the NPS-managed waters of the Lake Roosevelt. PWC use would continue to be allowed on the non-NPS-managed waters of the reservoir. However, these users would not be allowed to land or operate within the recreation boundary. This would eliminate potential impacts from personal watercraft to wildlife or habitat within the recreation area from physical disturbance, noise, or emissions, and would result in beneficial impacts to the resource relative to other alternatives.

Cumulative Impacts. The contribution of PWC use to cumulative impacts to wildlife and habitat in NPS-managed areas would be eliminated. Cumulative impacts from motorized boats would be similar to those described for alternatives A and B. Visitors using boats and other non-PWC watercraft, as well as those engaging in other activities, would have access to NPS shorelines and could cause temporary flight responses in wildlife. Cumulative adverse impacts to wildlife from visitor activities occurring on NPS-managed areas would be negligible to minor and temporary. Lake operations would cause minor to moderate adverse impacts to fish and wildlife habitat through lake level fluctuations and retention times. PWC use would continue to contribute to impacts on tribal wildlife and habitat resources, as PWC use would continue on or be displaced to tribal managed waters and launch sites as explained in the “PWC and Boating Use Trends” section.

Conclusion. PWC use would not be reinstated in NPS-managed waters on Lake Roosevelt, resulting in beneficial impacts on wildlife and wildlife habitat due to the elimination of interactions between PWC users and wildlife within the national recreation area. Cumulative adverse impacts on wildlife and wildlife habitat in the national recreation area would be short-term negligible to minor due to other visitor activities and minor to moderate from lake operations. PWC use would continue to contribute to cumulative adverse impacts on tribal managed wildlife and habitat resources because PWC use would continue on tribal managed waters of Lake Roosevelt.

Implementation of this alternative would not result in impairment to wildlife or wildlife habitat.

THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

The same issues described for PWC use and general wildlife also pertain to special status species. Potential impacts from personal watercraft include inducing flight and alarm responses, disrupting normal behaviors and causing stress, degrading habitat quality, and potentially affecting reproductive success. Special status species at the recreation area include federal or state listed threatened, endangered, or candidate species. Additionally, some species at Lake Roosevelt are designated by the state or other local governments as species of special concern.

GUIDING REGULATIONS AND POLICIES

The *Endangered Species Act* (16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species federal listed as threatened or endangered. If the National Park Service determines that an action may adversely affect a federal listed species, consultation with the U.S. Fish and Wildlife Service is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat.

An analysis of the potential impacts to those special status species that potentially could be affected by PWC use at Lake Roosevelt is included in this section. At Lake Roosevelt it has been determined that none of the alternatives are likely to adversely affect any of the listed species. The completed environmental assessment will be submitted to the U.S. Fish and Wildlife Service for its review. If the agency concurs with the finding of the National Park Service, no further consultation will be required.

Formal consultation would be initiated if the National Park Service determined that actions in the preferred alternative would be likely to adversely affect one or more of the federal listed threatened or endangered species identified in the recreation area. At that point a biological assessment would be prepared to document the potential effects. From the date of initiation of formal consultation, the Fish and Wildlife Service would be allowed 90 days to consult with the agency and 45 days to prepare a biological opinion based on the biological assessment and other scientific sources. The Fish and Wildlife Service would state its opinion as to whether the proposed PWC activities would be likely to jeopardize the continued existence of the listed species or to result in the destruction or adverse modification of critical habitat. Such an opinion would be the same as a determination of impairment. To ensure that a species would not be jeopardized by PWC activities, the National Park Service would confer with the Fish and Wildlife Service to identify recommendations for reducing adverse effects and would integrate those into the preferred alternative.

NPS *Management Policies 2001* state that potential effects of agency actions will also be considered regarding state or locally listed species. The National Park Service is required to control access to critical habitat of such species, and to perpetuate the natural distribution and abundance of these species and the ecosystems upon which they depend.

State and federal listed species were identified through discussions with park staff, and consultation of Washington Division of Fish and Wildlife and U.S. Fish and Wildlife resources. A consultation informing the agency of the action was sent to the U.S. Fish and Wildlife Service.

METHODOLOGY AND ASSUMPTIONS

Primary steps in assessing impacts on listed species within the national recreation area were taken to determine the following:

1. Which species are found in areas likely to be affected by management actions described in the alternatives.

2. Current and future use and distribution of personal watercraft by alternative.

3. Habitat loss or alteration caused by the alternatives.

4. Displacement and disturbance potential of the actions and the species' potential to be affected by PWC activities.

The information in this analysis was obtained through best professional judgment of park staff and experts in the field (as cited in the text), and by conducting a literature review.

Basic assumptions were made regarding personal watercraft and visitor activities, as follows:

1. The majority of PWC users operate their craft in a lawful manner.

2. Approximately 56 personal watercraft are on Lake Roosevelt during a peak summer day such as the 4th of July for an average of 3 hours per day.

3. Generally, impacts are expected to be similar or slightly greater in 2012 relative to 2002 due to the slight increase in PWC use at Lake Roosevelt of 1% per year. Approximately 62 personal watercraft would be on the water in 2012 on a peak use day.

4. PWC users who disembark on the shore would travel no more than 100 feet inland and would follow existing trails.

The PWC and visitor use trends data were used to evaluate impacts to threatened or endangered species. Additional information was obtained from park staff. Vegetation and wildlife information was provided by Lake Roosevelt resource specialists, existing NPS reports, and literature reviews.

IMPACT ANALYSIS AREA

The focus of this study is Lake Roosevelt and the surrounding shoreline area inland to approximately 200 feet. This 200-foot inland segment is assumed to provide a more encompassing range of assessment, based on the distance of PWC operation from the shoreline, wildlife responses to PWC activity, and the likely distance PWC users would travel inland. It is acknowledged that effects to wildlife and habitat in areas under jurisdiction of the Spokane and Colville Confederated Tribes would be similar to those in the NPS study area. However, the focus of this analysis includes portions of the reservoir and shoreline under NPS jurisdiction.

IMPACT OF PWC USE ON SUCH SPECIES

The *Endangered Species Act* defines the terminology used to assess impacts to listed species as follows:

No effect: When a proposed action would not affect a listed species or designated critical habitat.

May affect / not likely to adversely affect: Effects on special status species are discountable (i.e., extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated) or are completely beneficial.

May affect / likely to adversely affect: When an adverse effect to a listed species may occur as a direct or indirect result of proposed actions and the effect either is not discountable or is completely beneficial.

Is likely to jeopardize proposed species / adversely modify proposed critical habitat (impairment): The appropriate conclusion when the National Park Service or the U.S. Fish and Wildlife Service identifies situations in which PWC use could jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species within or outside park boundaries. This would be equivalent to impairment if the impact to listed species and their habitat would be affected to the point that the park's purpose (authorizing legislation, general management plan, and strategic plan) could not be fulfilled and resources could not be experienced and enjoyed by future generations.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use could affect threatened, endangered, or other special status wildlife wherever use occurs in close proximity to listed species or associated habitats. PWC use would occur throughout the main body of Lake Roosevelt and vessels could launch from sites that are distributed throughout the reservoir. All PWC, regardless of launching site, is assumed to recreate within the both national recreation area and tribal managed waters during an average trip. As noted in the methodology, PWC use is estimated at approximately 56 PWC users on a peak use summer day in 2002, increasing to an average of 62 PWC users per peak use day by 2012. Due to low water and air temperatures throughout the majority of the year, PWC use primarily occurs from June through September with peak use during July and August.

The following summarizes the impacts that would be expected from PWC use to the federal and state listed endangered, threatened and candidate species, and species of concern discussed under the "Affected Environment" chapter. In some cases, species previously mentioned in the "Affected Environment" chapter are not likely to occur in the limited area of water and shoreline that is within the area analyzed for impacts from personal watercraft and other watercraft. Generally, impacts are expected to be similar in 2012 relative to 2002 due to the only slight increase of 1% per year in PWC use in the area.

Special Status Animals – The Columbia River and Lake Roosevelt provide opportunities for wintering activity for bald eagles (federal and state listed threatened), as there is ample food supply available within the waters of the area. The over-wintering population of eagles at Lake Roosevelt is large, while the resident population is low. The highest PWC use at Lake Roosevelt occurs in July and August, which does not coincide with wintering bald eagle activity, but slightly overlaps with known nesting activity from January to July. Potential impacts to bald eagles include temporary disturbance from PWC noise or physical disturbance to individuals nesting near the shoreline. However, rising numbers of resident eagles at the recreation area in recent years suggest that PWC use or other motorized activities at Lake Roosevelt is not a limiting factor for area populations. PWC use or other motorized watercraft activities at the national recreation area may affect, but is not likely to adversely affect bald eagles or their habitat.

The presence of bull trout (federal threatened and state candidate) in the main body of Lake Roosevelt is unlikely, although individuals associated with tributary drainages have been caught near reservoir waters (Spokane Tribe of Indians 2002). PWC use within the national recreation area may affect, but is unlikely to adversely affect bull trout.

The remaining federal listed threatened or endangered species that were mentioned in the "Affected Environment" chapter include Canada lynx, gray wolf, woodland caribou, and grizzly bear. None of these species are believed to have resident populations within the recreation area, although habitat may exist in undeveloped forested areas near northern portions of the park. PWC use is expected to have no effect on Canada lynx, gray wolf, grizzly bear, or woodland caribou.

Three federal species of concern could potentially be affected by PWC use: the California bighorn sheep, American peregrine falcon, and black tern. Adverse impacts to California bighorn sheep are unlikely, as the population of sheep in the area is generally acclimated to human activity because of visitor activities, such as boating, that occur within the recreation area. Any effects to the species would be short-term and would likely only result in temporary disturbance from PWC noise and activity to individuals that are foraging near the shoreline. PWC use within the national recreation area may affect, but is unlikely to adversely affect California bighorn sheep.

Efforts are underway to re-establish a breeding population of peregrine falcons at Lake Roosevelt, but at this time there is no known breeding activity within the park (NPS 2000f, NPS 2001c). Primary use of the area by peregrines occurs during spring and fall migrations when there is typically no PWC use at Lake Roosevelt. Foraging activities of the falcons could potentially be affected by PWC noise and operational activity, but any effects would be minimal and short-term. PWC use within the national recreation area may affect, but is unlikely to adversely affect the American peregrine falcon.

Habitat for black terns exists along the Columbia River, including within the recreation area. Breeding habitat for black terns potentially exists along tributary drainages to Lake Roosevelt that support areas with notable emergent vegetation. Within the recreation area, these potential habitat areas are in locations not characterized by high PWC use. Flat-wake restrictions for all motorized vessels are in place at the majority of the suitable habitat locations, including Hawk Creek, and the upper Kettle River. PWC use within the national recreation area may affect, but is unlikely to adversely affect the black tern.

The Washington ground squirrel, the only federal candidate species in the park, is not thought to occur in areas that would be affected by PWC use. Therefore, PWC use within the national recreation area is expected to have no effect on federal candidate species.

The American white pelican (state endangered) could potentially utilize marshy areas of tributary drainages at Lake Roosevelt, but is not known to breed in the area. Potential habitat areas include Hawk Creek and the Kettle and Colville rivers where flat-wake restrictions exist for all watercraft, and high PWC use would not occur due to the shallow mature of the drainages. PWC use within the national recreation area may affect, but is not likely to adversely affect the American white pelican or its habitat.

Records exist of occasional occurrences of moose (state candidate) along the shoreline of Lake Roosevelt. Suitable foraging habitat for moose at Lake Roosevelt is located in wetland or marsh areas in side drainages and not in areas of high PWC use. Under alternative A, PWC use may affect, but is not likely to adversely affect moose or their habitat.

Special Status Plants – Personal watercraft provide access to the shoreline, and operators may disembark to explore shoreline areas. As a result, vegetation could be trampled by visitors.

The Ute ladies'-tresses orchid is the only federal listed plant species that could potentially occur at Lake Roosevelt. It is not known to occur within the recreation area, and potential habitat for the orchid is limited to wetland areas in side drainages where PWC use would not likely occur or would be restricted by flat-wake zones. PWC use would have no effect on Ute ladies'-tresses.

Of the other plant species of concern that are known to occur in the area, four species have potential habitat along or near the shoreline of Lake Roosevelt, although none are known to occur in the recreation area. Columbia crazyweed historically occurred along shoreline zones at the confluence of the Spokane and Columbia rivers. However, these populations were extirpated with the construction of the Grand Coulee dam and no known populations occur in the recreation area (WNHP 2002). PWC use would have no effect on Columbia Crazyweed.

The least bladdery milkvetch and Nuttall's pussytoes could potentially occur in upland areas as close as 100 feet to the Lake Roosevelt shoreline at full pool. This distance from the shoreline would not preclude impacts to these sensitive species from PWC use, as PWC could give visitors access to explore shoreline areas on foot. However, visitors are more likely to concentrate shoreline activities around already developed areas such as campgrounds and boat launches where the plants would not occur. PWC use within the national recreation area may affect, but is not likely to adversely affect populations of least bladdery milkvetch and Nuttall's pussytoes.

The giant helleborine is an orchid species that could potentially occur in wetland areas associated with Lake Roosevelt. Potential habitat for the species within the national recreation area is located in areas where PWC use is either non-existent or restricted by flat-wake designation. PWC use may affect, but is not likely to adversely affect the giant helleborine.

Cumulative Impacts. Cumulative impacts to the special status animal and plant species discussed above include impacts from visitor activities including motorized boating, other watercraft use, and shoreline recreational activities such as swimming and fishing. In addition, visitors who focus more on upland activities such as picnicking, camping, hiking, and hunting also may cause minor disturbances to the above species. However, most visitor activities occur in or near already disturbed or developed sites such as boat ramps, marinas, and camp or picnic areas where wildlife habitat is lacking.

Lake operations could potentially affect special status species through lake level fluctuations and resulting disturbance and/or degradation of shoreline and aquatic habitat. However, the above special status species do not have prime aquatic or shoreline habitat within the national recreation area that would likely be affected by lake operations. There are no other major foreseeable planned actions within Lake Roosevelt that would cause impacts to the species.

Cumulative impacts from visitor activities, including personal watercraft, or lake operations within the recreation area may affect but are not likely to affect federal or state listed species or other special status wildlife or plant species.

Conclusion. PWC use at Lake Roosevelt may affect, but is not likely to adversely affect the following species with federal or state status: bald eagle, bull trout, California bighorn sheep, American peregrine falcon, American white pelican, black tern, moose, least bladdery milkvetch, Nuttal's pussytoes, or giant helleborine. There would be no effect to all other federal or state listed species including the Canada lynx, gray wolf, grizzly bear, woodland caribou, Ute ladies'-tresses, or Columbia crazyweed. The identified special status species are either not permanent residents who are present during times of PWC use, do not have preferred habitat in the areas used by personal watercraft, are not usually accessible, or are generally acclimated to human activity. Similarly, cumulative effects from all park visitor activities within the national recreation area and lake operations may affect, but would not likely cause adverse effects to special status species due to lack of species occurrences and access to their habitats.

Implementation of this alternative would not result in an impairment of threatened or endangered species.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. This alternative would reinstate PWC use in NPS-managed waters at Lake Roosevelt as in alternative A, but with additional management strategies. In areas of additional flat-wake restrictions, noise and physical disturbance from personal watercraft would decrease in the areas of high visitor activity, where special status species are not likely to be present. The establishment of a resource monitoring program would assist in the detection and prevention of future impacts and would also lead to a minor reduction in the potential for PWC-related effects to special status species relative to alternative A.

Under alternative B, PWC use within the national recreation area may affect, but would not likely adversely affect special status species including bald eagle, bull trout, California bighorn sheep, American peregrine falcon, American white pelican, black tern, moose, least bladdery milkvetch, Nuttal's pussytoes, or giant helleborine. However, the potential for impacts to these species would be reduced relative to alternative A due to the implementation of resource monitoring. There would be no effect to all other federal or state listed species including the Canada lynx, gray wolf, grizzly bear, woodland caribou, Ute ladies'-tresses, or Columbia crazyweed as in alternative A. Over the next 10 years, impacts are not likely to increase within the national recreation area since PWC numbers are not expected to increase substantially. All impacts to special status species would be temporary and short term.

Cumulative Impacts. Under alternative B, cumulative impacts to special status species would be similar to alternative A and may affect, but would not likely adversely affect special status species or their habitat within the national recreation area. Cumulative activities result from lake operations as well as visitor activities that are concentrated mostly in developed areas rather than in habitat for or in areas of frequent occurrence by special status species.

Conclusion. Reinstatement of PWC use within the national recreation area with additional management strategies may affect, but is not likely to adversely affect, any of the listed wildlife or plant species. The potential for effects is less than under alternative A due to establishment of a resource monitoring program. While some disturbance could occur from PWC use, other visitor activities on the lake and shoreline, and lake operations, these cumulative impacts would not be of sufficient duration or intensity to cause adverse impacts. No impacts would occur in designated areas where personal watercraft would be prohibited or where additional speed or flat-wake restrictions would be enforced.

Implementation of this alternative would not result in an impairment of threatened or endangered species.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative, PWC use would not be reinstated on NPS-managed waters of Lake Roosevelt. The decrease in PWC use would result in beneficial impacts to threatened or endangered and other special status species due to the elimination of PWC-related physical disturbance, noise, or emissions within the national recreation area. PWC use would have no effect on listed species or associated habitat within the national recreation area.

Cumulative Impacts. Contribution of personal watercraft activity on NPS waters to cumulative impacts to federal or state listed animal and plant species would be eliminated. The other activities engaged in by visitors would be similar to those in alternatives A and B, and may affect, but are not likely to adversely affect, federal or state listed species within the national recreation area. Lake operations could also

contribute to cumulative impacts through lake level fluctuations. PWC use would continue on tribal managed waters and it is assumed that some PWC users would continue to use or be displaced to tribal waters and launch facilities as described in the "PWC and Boating Use Trends" section of this chapter. This PWC use may affect, but is not likely to adversely affect, any listed species. Impacts would be temporary and short-term as species are not normally present or accessible to visitor activities.

Conclusion. PWC users would not be allowed to operate in NPS-managed waters on Lake Roosevelt, resulting in elimination of potential effects to special status species and habitat from PWC use within the national recreation area. PWC use would continue on portions of Lake Roosevelt not managed by the National Park Service, and may affect, but is not likely to affect, any of the listed wildlife or plant species. Any impacts from personal watercraft would be short term. Cumulative effects from lake operations and non-PWC watercraft use and other visitor activities would be similar to other alternatives, and may affect, but are not likely to adversely affect special status species.

Implementation of this alternative would not result in an impairment of threatened or endangered species.

SENSITIVE SHORELINE VEGETATION

Personal watercraft are able to access areas that other types of watercraft may not, which may cause direct disturbance to vegetation. Indirect impact to shoreline vegetation may occur through trampling if operators disembark and engage in activities on shore. In addition, wakes created by personal watercraft may affect shorelines through erosion by wave action.

GUIDING REGULATIONS AND POLICIES

According to NPS management policy, natural shoreline processes such as erosion, deposition, overwash, inlet formation, and shoreline migration should continue without interference. Where the nature or rate of natural shoreline processes has been altered, the National Park Service is directed to identify alternatives for mitigating the effects of such activities or structures and for restoring natural conditions (NPS *Management Policies 2001,* [NPS 2000f] sec. 4.8.1.1). The National Park Service must also comply with the provisions of Executive Order 11990 ("Protection of Wetlands"), which requires federal agencies to avoid short- and long-term adverse impacts associated with the destruction or modification of wetlands whenever possible.

METHODOLOGY AND ASSUMPTIONS

Potential impacts to shoreline vegetation and to the shoreline itself (erosion that can affect shoreline communities) were evaluated based on the pattern of use of motorized watercraft on Lake Roosevelt, the nature of the shoreline and vegetation present, and the professional judgment and observations of park staff. To assess the magnitude of impacts from PWC use on shoreline vegetation within the national recreation area, the following assumptions were made:

1. The majority of PWC users operate their craft in a lawful manner.

2. Approximately 56 personal watercraft are on Lake Roosevelt during a peak summer day such as the 4th of July for an average of 3 hours per day.

3. Generally, impacts are expected to be similar or slightly greater in 2012 relative to 2002 due to the slight increase in PWC use at Lake Roosevelt of 1% per year. Approximately 62 personal watercraft would be on the water in 2012 on a peak use day.

4. PWC users who disembark on the shore would travel no more than 100 feet inland and would follow existing trails.

IMPACT ANALYSIS AREA

The impact analysis area for the assessment included the immediate water/land interface along the shoreline of Lake Roosevelt National Recreation Area where PWC use is allowed.

IMPACT TO SENSITIVE SHORELINE VEGETATION FROM PWC USE AND VISITOR TRAMPLING

Shoreline vegetation impacts were determined by examining the potential effects of personal watercraft and visitor use on vegetation, according to type and sensitivity. The number of personal watercraft and visitors and their distribution was based on the analysis provided in PWC and Boating Use Trends. The following impact thresholds were established to describe the relative changes in shoreline vegetation under the various alternatives being considered:

Negligible: Impacts would have no measurable or perceptible changes in plant community size, integrity, or continuity.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in the plant community (e.g., abundance, distribution, quantity, or quality); however, the impact would remain localized.

Major: Impacts to the plant community would be substantial, highly noticeable, and permanent.

Impairment: PWC use would contribute substantially to the deterioration of the shoreline or shallow water environment to the extent that the park's shoreline or submerged vegetation would no longer function as a natural system. In addition, these adverse major impacts to park resources and values would:

- Contribute to deterioration of these resources to the extent that the park's purpose could not be fulfilled as established in its authorizing legislation;
- Affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or
- Affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning documents.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC management strategies in place prior to the November 2002 closure would be reinstated to manage PWC use. Personal watercraft would be allowed throughout the body of Lake Roosevelt and would originate at launch sites distributed throughout the recreation area. Restrictions would include prohibition of all watercraft from Crescent Bay Lake, flat-wake zones in Hawk Creek, and flat-wake zones in the upper Kettle River.

Due to water level fluctuations from lake operations as well as wind and boating-induced wave action, notable areas of shoreline vegetation are lacking at Lake Roosevelt. Sensitive riparian and/or wetland vegetation is not found on the shoreline of the main body of the reservoir, but is located in side drainages such as Hawk Creek and the Kettle River. These areas are protected by flat-wake restrictions for all motorized vessels, and direct impact to shoreline vegetation from personal watercraft in these areas is unlikely because speeds and maneuverability are limited. Foot access into areas from PWC operators would also be limited due to the difficulty of water access. Therefore, adverse impacts to sensitive shoreline vegetation from PWC use would be negligible and short term.

Shorelines would be more susceptible to erosion from PWC-caused wave action during times when water levels are low. However, drawdowns typically occur in the spring when water temperatures are too low for PWC use, though drawdowns of up to 12 feet may occur in the summer visitor use season. Adverse impacts to the shoreline related to erosion from PWC-induced wave action within the national recreation area would be negligible and short term.

Cumulative Impacts. Non-PWC watercraft make up over 95% of all boating use within the national recreation area. In some locations, visitors may access shoreline areas and trails by these other vessels or by automobile. Due to the lack of sensitive shoreline vegetation in areas of major visitor use, adverse cumulative impacts from visitor access would be negligible.

Shoreline erosion is primarily caused by lake operations and wind-caused wave action. Wave action is only likely to affect the shoreline in open areas when the reservoir is at full pool, and would result in negligible adverse effects to the sensitive shoreline vegetation. The more isolated sensitive riparian and wetland vegetation in tributary drainages would not be affected because of its sheltered location. However, lake operations could potentially cause minor adverse impacts to sensitive vegetation in these areas through lake level fluctuations. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas.

Conclusion. PWC use would result in negligible adverse effects on shoreline vegetation because shoreline vegetation is generally lacking. Sensitive wetland and riparian areas are located in inaccessible or protected areas with regulated PWC access. Watercraft activity could cause negligible adverse impacts to shorelines through watercraft-induced wave action or visitor access. Wind-caused wave action and lake level fluctuation could cause negligible impacts through erosion to the shoreline of the open areas of the reservoir. Lake level fluctuations could also potentially have minor adverse impacts to sensitive vegetation in side drainages. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas.

Implementation of this alternative would not result in an impairment of shoreline vegetation.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. PWC use would be reinstated in NPS-managed waters at Lake Roosevelt as in alternative A, but with additional management strategies. Additional flat-wake restrictions would be implemented in areas of high visitor activity, but accessibility to the shoreline would not change from alternative A. The establishment of a resource monitoring program could assist in both the detection of sensitive vegetation communities that may establish along the shoreline, and the determination of the need for implementation of future restrictions to prevent future impacts. This would benefit sensitive shoreline vegetation resources in the national recreation area.

Cumulative Impacts. Cumulative adverse impacts related to all watercraft activity and other visitor activities would be the same as described for alternative A and would be negligible. Impacts from Lake level fluctuation would continue to be negligible to minor. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas.

Conclusion. Impacts to shoreline vegetation would be the same as alternative A, although some benefit could result from resource monitoring if sensitive vegetation communities become established. Cumulative adverse impacts from motorized boats and other watercraft, other visitor activities, and wind-caused wave action would remain negligible, while impacts from lake level fluctuations would be negligible to minor. Cumulative impacts to tribal managed shorelines at Lake Roosevelt from motorized boating and PWC use would be similar to impacts on NPS-managed areas.

Implementation of this alternative would not result in an impairment of shoreline vegetation.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. PWC use on NPS-managed waters of Lake Roosevelt would not be reinstated under the no-action alternative, eliminating the possibility of any impacts to shoreline vegetation from PWC use within the national recreation area. There would be beneficial impacts to sensitive shoreline vegetation where it might exist from reduced PWC access, wave action, or direct physical disturbance from personal watercraft. PWC use would continue on waters of Lake Roosevelt under tribal jurisdiction; however, these users would not be able to land their personal watercraft on NPS shorelines.

Cumulative Impacts. Cumulative impacts would be similar to those described for alternative A, except that PWC contribution to these impacts would be eliminated due to the NPS ban on personal watercraft. Use of other motorized vessels, such as boats would continue to be a source of negligible adverse impacts on sensitive shoreline vegetation. Potential negligible impacts from PWC use could still occur on tribal shorelines, as use would continue in tribal managed waters. Physical processes such as wind-caused wave action and lake level fluctuations would cause negligible to minor adverse cumulative impacts on sensitive shoreline vegetation associated with tributaries to the reservoir.

Conclusion. PWC use would not be reinstated within the recreation area, resulting in the elimination of personal watercraft from NPS-managed waters and some beneficial impacts to shoreline vegetation similar to alternative B. Cumulative impacts from watercraft activity, other visitor uses and physical processes would continue, and would be negligible to minor, although the long-term PWC contribution to these impacts would be eliminated along NPS shorelines. The above Cumulative impacts would also be

applicable to tribal managed shorelines. In addition, PWC use would continue to contribute to cumulative impacts to tribal managed shorelines.

Implementation of this alternative would not result in an impairment of shoreline vegetation.

VISITOR USE AND EXPERIENCE

Some research suggests that PWC use is viewed by some segments of the public as a nuisance due to their noise, speed, and overall environmental effects, while others believe personal watercraft are no different from other watercraft and that people have a right to enjoy the sport. The primary concern involves changes in noise, pitch, and volume, due to the way personal watercraft are operated. Additionally, the sound of any watercraft can carry for long distances, especially on a calm day.

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2001* state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Because many forms of recreation can take place outside a national park setting, the National Park Service will therefore seek to:

- Provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in a particular unit

- Defer to local, state, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting

Unless mandated by statute, the National Park Service will not allow visitors to conduct activities that:

- Would impair park resources or values

- Would create an unsafe or unhealthful environment for other visitors or employees

- Are contrary to the purposes for which the park was established

- Would unreasonably interfere with the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park; NPS interpretive, visitor service, administrative, or other activities; NPS concessioner or contractor operations or services; or other existing, appropriate park uses.

Part of the purpose of Lake Roosevelt National Recreation Area is to offer opportunities for recreation, education, inspiration, and enjoyment. The recreation area offers a wide variety of recreational opportunities in a diverse natural setting on a 154-mile-long lake, bordered by 312 miles of publicly owned shoreline available for public use. One of the national recreation area's purposes is to "provide opportunities for diverse, safe, quality, outdoor recreational experiences for the public." To achieve the park's goals, two long-term (five-year) visitor goals were identified in the *Strategic Plan:*

- *Visitor Satisfaction* — By September 30, 2005, 91% of visitors to Lake Roosevelt National Recreation Area are satisfied with appropriate facilities, services, and recreational opportunities.

- *Visitor Safety* — By September 30, 2005, the number of Lake Roosevelt National Recreation Area visitor accidents/incidents is no higher than the FY 1992 – FY 1996 five-year annual average of 15.2.

Both goals focus on maintaining high visitor satisfaction by means of appropriate and safe recreational opportunities and experiences.

The national recreation area's mission directs the park to conserve "unimpaired, the natural and cultural resources and recreational and scenic values of Lake Roosevelt for the enjoyment, education, and inspiration of this and future generations" (NPS 2000c).

METHODOLOGY AND ASSUMPTIONS

The purpose of this impact analysis was to determine if PWC use at Lake Roosevelt National Recreation Area is compatible or in conflict with the purpose of the park, its visitor experience goals, and the direction provided by NPS *Management Policies*. Thus, these policies and goals were integrated into the impact thresholds.

To determine impacts, the current level of PWC use (prior to the November 6, 2002 PWC closure) was calculated for the recreation area (see the "PWC and Boating User Trends" section). Staff observations and visitor surveys were evaluated to determine visitor attitudes and satisfaction in areas where personal watercraft were used.

The potential for change in visitor experience was evaluated by identifying projected increases or decreases in both personal watercraft and other visitor uses, and determining whether these projected changes would affect the desired visitor experience and result in greater safety concerns or additional user conflicts.

IMPACT ANALYSIS AREA

In terms of PWC use, the impact area is defined as all areas of Lake Roosevelt National Recreation Area that are open to PWC use as described in the Superintendent's Compendium. No motorized watercraft is permitted on Crescent Bay Lake. In addition, PWC use may affect visitors at beaches, trails, and campgrounds near the shoreline, such that visitors within 200 feet of the shore of Lake Roosevelt are considered to be within the affected area.

IMPACT OF PERSONAL WATERCRAFT ON VISITOR EXPERIENCE GOALS

The following thresholds were defined:

Negligible: Visitors would not likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources.

Minor: Visitors would likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources; however the changes in visitor use and experience would be slight and likely short term. Other areas in the park would remain available for similar visitor experience and use without derogation of park resources and values.

Moderate: Visitors would be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and likely long term. Other areas in the park would remain available for similar visitor experience and use without derogation of park resources and values, but visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors who desire to continue their use and enjoyment of the activity/visitor experience would be required to pursue their choice in other available local or regional areas.

Major: Visitors would be highly aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and long term. The change in visitor use and experience proposed in the alternative would preclude future generations of some visitors from enjoying park resources and values. Some visitors who desire to continue their use and enjoyment of the activity / visitor experience would be required to pursue their choice in other available local or regional areas.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC operators under alternative A would be allowed throughout the recreation area, with limitations only in areas previously managed with use restrictions including: no motorized watercraft in Crescent Bay Lake; flat wake on the upper Kettle River above the Napoleon Bridge; and flat wake on upper Hawk Creek from the waterfall near the campground through the area known as the “narrows.” Based on an increase of 1% per year PWC use is expected to increase from 37 personal watercraft on a typical summer season day to 41 personal watercraft per day by 2012. Peak use days would experience an increase from 56 to 62 personal watercraft per day.

Impact on PWC Users — There would be no change to PWC use or activity as compared to conditions prior to the November 2002 PWC closure. Alternative A would have negligible impact on the visitor experience of PWC users at Lake Roosevelt National Recreation Area.

Impact on Other Boaters — Other boaters at Lake Roosevelt National Recreation Area would interact with PWC operators on an increasing basis as overall boating numbers increase over the next ten years. PWC use is expected to increase at the same rate as other boat use; however, personal watercraft would still only comprise approximately 4% of total boats on Lake Roosevelt in 2012. High-use areas for PWC users and boaters include Porcupine Bay, Fort Spokane, Kettle Falls, and Bradbury Beach.

Generally, few non-motorized watercraft (sea kayaks, canoes, and windsurfers) use Lake Roosevelt, so interactions with these user groups would be infrequent. In addition, the flat-wake-speed areas on the upper Kettle River above the Napoleon Bridge, and on upper Hawk Creek provide calmer waters that lead to creeks favored by canoeists and kayakers. Under alternative A, short- and long-term adverse impacts to non-motorized boaters would be negligible to minor.

Motorized boats are more likely to interact with personal watercraft. The most common area for personal watercraft / boater interaction is near the boat launches, as the majority of motorized boats enter the water at the marinas and then motor into the main body of the lake. With increasing boat and PWC numbers, the potential for interactions between the user groups would also increase resulting in long-term negligible to minor adverse impacts on the visitor experience of boaters using other motorized vessels.

Impact on Other Visitors — Campers, swimmers, anglers, hikers, and other shoreline visitors to the reservoir would have contact with PWC users. Shoreline areas that are popular with both personal watercraft and other shoreline users include Spring Canyon, Porcupine Bay, Fort Spokane, Kettle Falls, and Bradbury Beach. The Washington state boating regulation that requires a 100-foot no-wake speed zone around any swimming area or person on the shore engaged in fishing would be enforced.

Swimming is permitted within the national recreation area, and designated swim beaches occur at many lakeshore campgrounds. Popular swim beaches are at Crescent Bay, Spring Canyon, Porcupine Bay, Fort Spokane, and Bradbury Beach. Swimming and PWC use could occur together at Spring Canyon, Porcupine Bay, Fort Spokane, and Bradbury Beach resulting in conflict. Due to the projected increase in PWC numbers, PWC use under alternative A would result in a long-term minor adverse impact on the experience of swimmers.

There are fifteen campgrounds on the reservoir with boat launch facilities, and thus could have PWC use in the direct vicinity of the campground. Of these campground sites, high PWC-use occurs at Spring Canyon, Porcupine Bay, Fort Spokane, and Kettle Falls. Under alternative A, PWC use would have long-term negligible to minor adverse impacts on the experience of visitors to park campgrounds.

Along the lakeshore, Fort Spokane, Spring Canyon, and Kettle Falls have the most accessible and well marked trails, and roads and miles of undesignated hiking trails provide access to much of the lake shoreline for hiking and angling. PWC use in areas that are popular with both personal watercraft and other shoreline visitors (hikers, anglers) could affect visitors seeking natural quiet. Visitors who seek solitude can recreate at Crescent Bay Lake and along the upper reaches of the Spokane River, Kettle River, and the Columbia River. In addition, many shoreline visitors are travelers stopping to enjoy the scenery and picnic, not necessarily to have a solitude experience. PWC use under alternative A would not result in a noticeable change in the experience of shoreline visitors; however, violations of no-wake zones and PWC use at congested shoreline areas of Lake Roosevelt could result in long-term negligible to minor adverse impacts on the experiences of these shoreline visitors.

Cumulative Impacts. The primary activities at Lake Roosevelt National Recreation Area that could affect visitor experiences include the number and activities of other visitors and noise from vehicles and motorboats. The Bureau of Reclamation regulates the lake level; however, it is difficult to predict the effects of drought conditions and downstream water needs on future lake levels and the impacts related to lake level fluctuations. Plans to expand or improve visitor facilities at the national recreation area could contribute to cumulative impacts on visitor experience. Plans for facility additions include the addition of a concession marina at Crescent Bay, a small concession facility at the Hunters boat launch, and a possible relocation of the Kettle Falls Marina to a deeper water area upstream of the current location. Facility improvement plans include improvements to the Bradbury Beach swim and parking areas (NPS 2002b). The above plans are designed to have beneficial impacts on visitor use and experience by allowing dispersal of visitor use within the national recreation area.

Predictable cumulative impacts related to the use of personal watercraft, motorized boats, and other visitor activities would be negligible to minor adverse over the short term and beneficial over the long term. These cumulative impacts would also be applicable to adjacent tribal managed visitor use areas.

Conclusion. Reinstated PWC use at Lake Roosevelt National Recreation Area would cause negligible to minor adverse impacts on experiences for most visitors to the national recreation area in the short and long-term. Swimmers and other shoreline users would be most affected by PWC use at popular day-use areas used by personal watercraft, such as Crescent Bay, Spring Canyon, Porcupine Bay, Fort Spokane, and Bradbury Beach. PWC use would have negligible to minor adverse impacts on other boaters due to increased congestion at popular boat launches. PWC use would have long-term, negligible to minor adverse impacts on swimmers and those visitors desiring natural quiet. Cumulative effects of PWC use, other watercraft, and other visitors would result in short- and long-term, negligible to minor adverse impacts on visitor experience goals. Plans for future expansion or improvements to visitor facilities within the national recreation area would have long-term beneficial impacts on visitor experience. These cumulative impacts would also be applicable to adjacent tribal managed visitor use areas.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. PWC use would be reinstated within the national recreation area as under alternative A, with additional management prescriptions. PWC operation would only be allowed to occur at flat-wake speed within 200 feet of launch ramps, marina facilities, campground areas, swim beaches, water skiers and other persons in the NPS designated waters, and on the stretch of the Spokane Arm from 100 feet west of the Two Rivers Marina to 100 feet east of the launch ramp above the vehicle bridge. In addition, the National Park Service would establish a monitoring program to determine if and when additional regulations would be needed. PWC use could potentially be further restricted in certain areas depending on the results of future monitoring.

Impact on PWC Users — The designation of flat-wake zones in the above mentioned areas would have a negligible to minor adverse impact on the experience of PWC users as all of Lake Roosevelt would still be accessible to PWC use, and the lake waters administered by tribal entities would not experience these restrictions. Implementation of the monitoring program would result in negligible to major adverse impacts on PWC users in later years, depending upon the results of monitoring. Overall, alternative B would have a long-term negligible to minor adverse impact on PWC users within the national recreation area.

Impact on Other Boaters — As under alternative A, other boaters at Lake Roosevelt National Recreation Area would interact with PWC operators and experience impacts similar to alternative A. The 200-foot flat-wake zone around launch ramps, marina facilities, and the no-wake zone on the stretch of the Spokane River at Two Rivers marina would benefit other boaters (motorized and non-motorized), as personal watercraft would be speed-restricted. Boaters in other areas of the lake would see impacts similar to those under alternative A. Overall, long-term impacts on the experience of other boaters would be beneficial.

Impact on Other Visitors — As under alternative A, campers**,** swimmers, water skiers, anglers, hikers, and other shoreline visitors to the lake would interact with PWC users and experience impacts similar to alternative A. Swimmers and other persons in the water at shoreline areas that are also popular with personal watercraft would experience beneficial impacts as a result of the increased flat-wake zone designations. Shoreline campers would experience a beneficial impact. Backcountry hikers would experience impacts similar to alternative A – negligible to minor adverse. Depending on the results of the PWC monitoring program, all visitors would experience anywhere from negligible to minor adverse, to beneficial impacts on their experience. Overall, implementation of alternative B would result in long-term beneficial impacts on swimmers, shoreline campers, shoreline anglers, and water skiers, and negligible to minor adverse impacts on backcountry hikers.

Cumulative Impacts. Cumulative impacts would be the same as alternative A. Cumulative impacts related to the use of personal watercraft, motorized boats, and other visitor activities would be negligible to minor adverse over the short and long term and would be similar for visitors to tribal managed facilities and waters. Plans to expand or improve visitor facilities on Lake Roosevelt would contribute long-term beneficial impacts to all visitor groups due to the enhanced potential for distribution of visitor activities to prevent congestion.

Conclusion. Designation of the flat-wake zones would have negligible to minor adverse impacts on most PWC users within the national recreation area since these areas would not be available for high-speed maneuvering; however, all of the lake surface would still be accessible to PWC users. Other boaters and shoreline users would experience beneficial impacts, especially at launch areas and high-use facilities. Swimmers, water skiers, and other persons in the water would experience beneficial impacts on their experience.

Cumulative effects of PWC use, other motorized boats, and other visitors would result in long-term, negligible to minor adverse impacts, while plans to improve or expand facilities would have long-term beneficial impacts on visitor experience within the national recreation area. Cumulative impacts from PWC use, motorized boats, and other visitors would also be applicable to adjacent tribal managed visitor use areas.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Personal watercraft would continue to be prohibited from the NPS-managed waters of Lake Roosevelt and visitors would not be allowed to participate in this form of recreation within the national recreation area. Personal watercraft are estimated to comprise 4% of all vessels on the reservoir, which represents a small percentage of visitors. Based on current use projections and an average 1.5 users per personal watercraft, in 2012 approximately 48 PWC riders would not be able to enjoy this experience within the national recreation area on a typical summer season day. This number constitutes a very small percentage of the daily visitation, and would not preclude the park from its goal of offering a wide range of recreational activities.

Impact on PWC Users — Continuing to ban PWC use on park waters would initially have a moderate to major adverse impact on PWC users who are accustomed to launching from park launch ramps, because they would not be allowed to operate personal watercraft in park waters. Although PWC use would continue to be allowed on tribal managed waters within Lake Roosevelt, PWC users displaced from NPS facilities would be required to drive a greater distance to access the tribal launch facility at Two Rivers Marina. Detailed assumptions of continued or displaced PWC use are presented in the "PWC and Boating Use Trends" section. PWC users who are accustomed to launching from the tribal launch ramps would experience a minor to moderate adverse impact, as launch ramps would become more crowded. All PWC users would experience crowding and a moderate adverse impact on experience, as waters that remain open to personal watercraft would become more crowded. However, discontinuing PWC use would not necessarily preclude a visit to NPS-managed waters by PWC owners via another type of vessel. Nationally, approximately 68% of PWC owners previously owned powerboats (NTSB 1998). Current PWC users could still use a motorboat or other watercraft on all of the lake and could continue to experience activities such as hiking, sightseeing, and camping. Thus, the level of impact to all PWC users on Lake Roosevelt is expected to be moderate adverse in the short and long term.

Impact on Other Boaters — Continuation of the ban on PWC use from park-administered waters of Lake Roosevelt would eliminate interactions between other boaters and PWC operators on these waters, and

these other boaters would experience a beneficial impact. However, assuming that PWC users would continue to use Lake Roosevelt on tribal waters, and since overall boating numbers are expected to increase over time, conditions would become more crowded on the tribal-managed areas of the lake. Further, since the Two Rivers Marina would be the only PWC launch area on Lake Roosevelt, conditions in the vicinity of the Two Rivers Marina (park- and non-park-administered waters) would result in minor to moderate adverse impacts on visitor experience. Implementation of this alternative would result in a beneficial impact on boaters on NPS-managed waters, and a minor to moderate adverse impact on boaters on tribal waters.

Impact on Other Visitors — Continuing the ban on PWC use within the NPS-managed waters of the national recreation area would have a beneficial effect on other shoreline users, especially swimmers and anglers. Campers, shoreline hikers, and anglers would experience reduced disturbance in the traditional high PWC use areas, but would still be exposed to activities of other motorized watercraft and personal watercraft in tribal waters. On tribal shorelines, visitors would experience minor adverse impact due to increase of PWC use on these waters.

Cumulative Impacts. Cumulative impacts would be similar to alternatives A and B. Negligible to minor impacts on visitor experience would continue from all non-PWC visitor activities such as motorized boating in the recreation area, although the contribution from PWC use to cumulative visitor would be eliminated. Plans to expand or improve visitor facilities on Lake Roosevelt would have long-term beneficial impacts due to an increase in potential for dispersal of visitor activities.

PWC use would continue on tribal waters as described in the “PWC and Boating Use Trends” section, and in combination with other visitor activities including motorized boating, would cumulatively affect visitors to tribal managed facilities and waters. On a regional basis the no-action alternative would likely result in a negligible long-term adverse effect to PWC activities on other water bodies in the region as a result of PWC users going to other locations to participate in this activity.

Conclusion. The continued ban of personal watercraft on NPS-managed waters would have a beneficial impact on the experiences of most non-PWC visitors to the national recreation area, and minor to moderate adverse impacts on visitors to tribal-managed launch facilities due to increased crowding. Impacts on all PWC users would be long term, moderate, and adverse. Cumulative impacts would include a negligible long-term adverse effect on PWC users at nearby water bodies that would potentially receive increased PWC use. Plans for future facilities improvements would result in long-term beneficial impacts on visitor experience.

VISITOR CONFLICTS AND SAFETY

Industry representatives report that PWC accidents decreased in some states in the late 1990s. The National Transportation Safety Board reported that in 1996 personal watercraft represented 7.5% of state-registered recreational boats but accounted for 36% of recreational boating accidents. In the same year, PWC operators accounted for more than 41% of people injured in boating accidents. PWC operators accounted for approximately 85% of the persons injured in accidents studied in 1997 (NTSB 1998). Since PWC operators can be as young as 12 in several states, accidents can involve children. The American Academy of Pediatrics (2000) recommends that no one younger than 16 operate personal watercraft.

Of the 46 incidents on Lake Roosevelt reported to the National Park Service between 1997 and 2002, 17% (or eight incidents) involved a personal watercraft. Further, 55% of incidents that involved two vessels making contact with each other (five out of nine incidents) involved at least one personal

watercraft, and three of the five two-vessel incidents (or 33%) involved two personal watercraft striking each other. One PWC accident resulted in the death of the operator.

PWC speeds, wakes, and operations near other users can pose hazards and conflicts. Proportionally, there have been more complaints received by park staff about unsafe behavior by PWC users than any other watercraft users. Complaints have also been received from anglers, swimmers, and canoeists concerning speed of and wakes created by personal watercraft.

GUIDING REGULATIONS AND POLICIES

In addition to the guiding regulations and policies discussed in the "Visitor Experience" section, the NPS *Management Policies 2001* state that the agency is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. The policies also state, "While recognizing that there are limitations on its capacity to totally eliminate all hazards, the Service and its concessioners, contractors and cooperators will seek to provide a safe and healthful environment for visitors and employees" (section 8.2.5.1) Further, the National Park Service will strive to protect human life and provide for injury-free visits (section 8.2.5).

Director's Order #9: Law Enforcement Program (NPS 2000a), in conjunction with *Reference Manual 9: Law Enforcement,* establishes and defines standards and procedures for NPS law enforcement. Along with education and resource management, law enforcement is an important tool in achieving this mission. Commissioned rangers perform resource stewardship, education, and visitor use management activities, including law enforcement. They provide for tranquil, sustainable use and enjoyment of park resources while simultaneously protecting these resources from all forms of degradation. The objectives of the law enforcement program are to (1) prevent criminal activities through resource education, public safety efforts, and deterrence, (2) detect and investigate criminal activity, and (3) apprehend and successfully prosecute criminal violators.

PWC users would continue to abide by Washington state watercraft laws and regulations. Current Washington state boating laws applicable to PWC use that have been incorporated into all action alternatives include:

Safety Requirements:

- Riders are required to wear a Coast Guard approved Type I, II, III, or V Personal Floatation Device (PFD), or a wet suit which is approved for personal flotation by the United States Coast Guard.

- Riders are required to have a cut-off device, attached to the operator, if installed by the manufacturer.

Age Restriction:

- Operators of personal watercraft must be at least 14 years of age.

- It is unlawful to lease, hire, or rent a personal watercraft to any person under 16 years of age.

Timing Restriction:

- No person shall operate a personal watercraft on the waters of Washington State during the period from sunset until sunrise.

Reckless Behavior:

- No person engaged in the operation of a personal watercraft shall conduct themselves in a reckless manner that endangers, or is likely to endanger, any person or property.

- Within 100 feet of marked swimming or boat access areas, vessels shall be operated at the minimum speed necessary to maintain steerageway.

Water patrols and enforcement, in conjunction with cooperating agencies, would continue on an irregular basis during the primary PWC use season (mid-June to Labor Day).

METHODOLOGY AND ASSUMPTIONS

The methodology for visitor conflicts and safety is similar to that used for visitor experience. The potential visitor-related impacts attributable to personal watercraft — a higher rate of accidents than for other watercraft, conflicts with other park users, negative effects on some types of visitor experiences — could potentially affect the mandate to provide for injury-free visits. Potential impacts were identified based on the number and activities of personal watercraft operating within the area, the number and activities of other visitors in an area, and the proximity of these user groups.

It is assumed that Washington state PWC regulations are enforced within the national recreation area. These regulations govern PWC activities near the shore, the timing of use, and the age and educational requirements of operators.

IMPACT ANALYSIS AREA

In terms of PWC use, the impact area is defined as all areas of Lake Roosevelt National Recreation Area that are open to PWC use as described in the Superintendent's Compendium. This includes the entire body of Lake Roosevelt. No motorized craft is permitted on Crescent Bay Lake. In addition, PWC use may affect visitors at beaches, trails, and campgrounds near the shoreline, such that visitors within 200 feet of the shore of Lake Roosevelt are considered to be within the affected area.

IMPACT OF PWC USE AND CONFLICTING USES ON VISITOR SAFETY

The impact intensities for both visitor conflicts and safety follow. Where impacts to visitor experience or visitor safety become minor or moderate, it is assumed that current visitor satisfaction and safety levels would begin to decline and the park would not be achieving some of its long-term visitor goals.

Negligible: The impact to visitor safety would not be measurable or perceptible.

Minor: The impact would be measurable or perceptible, and it would be limited to a relatively small number of visitors at localized areas. Impacts to visitor safety

could be realized through a minor increase or decrease in the potential for visitor conflicts in current accident areas.

Moderate: The impact to visitor safety would be sufficient to cause a permanent change in accident rates at existing low accident locations or to create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends.

Major: The impact to visitor safety would be substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC operators under alternative A would be allowed throughout the recreation area, with limitations only in areas currently managed with use restrictions including: no motorized craft in Crescent Bay Lake; no wake on the upper Kettle River above the Napoleon Bridge; and no wake on upper Hawk Creek from the waterfall near the campground through the area known as the "narrows."

Personal Watercraft / Swimmer Conflicts — The greatest potential for conflict between personal watercraft and swimmers is at the high-use areas near Spring Canyon, Porcupine Bay, Fort Spokane, Kettle Falls, and Bradbury Beach. The Washington state boating regulation that requires a 100-foot minimum speed zone around any swimming area or person on the shore engaged in fishing would be enforced. Further, when PWC operators fall or are thrown from their personal watercraft, the machine can continue running, and documented cases describe unmanned personal watercraft harming swimmers in Michigan and Florida (NTSB 1998). Voluntary boater safety classes are available to educate PWC users on ways to minimize accidents.

An estimated 56 personal watercraft would be operated on the lake during peak use days, many of which would likely concentrate near popular national recreation area swim areas and may violate the speed restrictions to beach, pick up passengers, or change operators. Even though no PWC-related accidents have occurred involving a swimmer, the park has received complaints from swimmers about personal watercraft not slowing down as required in the presence of swimmers. Due to the concentration of visitors that use these areas, impacts regarding swimmer safety at these locations are predicted to be minor to moderate adverse.

The remaining park locations would experience little or no conflict between PWC users and swimmers. There are few swimmers in other areas of the national recreation area that are frequented by personal watercraft. Thus conflicts in these segments would constitute negligible adverse impacts.

Personal Watercraft / Other Boat Conflicts — Personal watercraft represent an estimated 4% of all vessels at Lake Roosevelt. Potential for incidents or accidents at congested boat ramps exists but the impact of PWC use on safety would be considered negligible to minor. Personal watercraft could come into conflict with non-motorized boats in the no-wake speed areas, where personal watercraft have violated the no-wake speed rules. Impacts to other boaters would be negligible to minor adverse and would be concentrated primarily at the boat launches and high PWC use areas.

Personal Watercraft / Other Visitors Conflicts — Lake Roosevelt and its shoreline are used by a variety of visitors, including anglers, hikers and campers. Shoreline areas that are popular with both personal

watercraft and other shoreline users include Spring Canyon, Porcupine Bay, Fort Spokane, Kettle Falls, and Bradbury Beach. In the past, conflicts between PWC riders and other shoreline users have not been a major issue at Lake Roosevelt, although negligible to minor conflicts could potentially occur from PWC disturbance to anglers and hikers.

There are 13 NPS-managed campgrounds on the reservoir with boat launch facilities that could have PWC use nearby, resulting in visitor conflicts in the vicinity. Of these campground sites, high PWC use occurs at Spring Canyon, Porcupine Bay, Fort Spokane, and Kettle Falls. Impacts on campground visitors would be similar to those described on other shoreline visitors and would be negligible to minor adverse.

Since PWC use within the national recreation area is expected to increase by only four personal watercraft per high-use day by 2012, conflicts and safety issues between PWC users and other visitors would not be expected to increase dramatically. Thus, under this alternative, PWC impacts on safety of non-boating visitors would be negligible to minor adverse for both 2002 and 2012.

Cumulative Impacts. NPS-managed waters of Lake Roosevelt and associated shorelines are used by a variety of visitors, including swimmers, motorboat users, kayakers, canoeists, campers, anglers, and hikers. All of these user groups interact with each other and occasionally come into conflict. Some user groups are more evenly distributed than others. For example, kayakers, canoeists, and swimmers tend to stay close to the shore, whereas PWC and motorboat operators tend to operate at least 150 feet offshore, unless landing and taking off. This separation of use reduces the potential for conflicts between the various groups. However, several of these user groups favor the same general location. For this reason, the cumulative impact of the various user groups on visitor conflicts and safety within the national recreation area would be negligible to minor adverse over the short and long term. Plans to expand or improve visitor facilities on Lake Roosevelt could contribute to cumulative impacts on visitor safety and conflicts. Facility additions include plans to add a concession marina at Crescent Bay, a small concession facility at the Hunters boat launch, and a possible relocation of the Kettle Falls Marina to a deeper water area upstream of the current location. Facility improvement plans include improvements to the Bradbury Beach swim and parking areas (NPS 2002b). The above plans are designed to have beneficial impacts on visitor safety and conflicts by allowing dispersal of visitor use on Lake Roosevelt. Cumulative impacts from all visitor user groups to visitors of tribal managed facilities and waters would be similar to those for NPS visitors.

Conclusion. Reinstated PWC use within the national recreation area would have negligible to minor adverse impacts on other boaters in the short and long term. Under this alternative, PWC use would have minor to moderate adverse impacts related to conflicts and safety of swimmers, and negligible to minor adverse impacts on other shoreline visitors particularly in the noted high PWC use locations.

Cumulative impacts related to visitor conflicts and safety would be minor adverse for all user groups in the short and long term, particularly near the high-use areas. Cumulative impacts in other areas of the lake would be negligible. Cumulative impacts from all visitor user groups to visitors of tribal managed facilities and waters would be similar to those for NPS visitors. Cumulative impacts due to facilities improvements would be beneficial to all visitors within the national recreation area.

Overall, most visitors to Lake Roosevelt National Recreation Area would experience minor adverse effects under this alternative.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. PWC use would be reinstated as under alternative A, but with additional management prescriptions. PWC operation would only be allowed to occur at no-wake speed within 200 feet of launch ramps, marina facilities, campground areas, swim beaches, water skiers and other persons in the NPS designated waters, and on the stretch of the Spokane Arm from 100 feet west of the Two Rivers Marina to 100 feet east of the launch ramp above the vehicle bridge. In addition, the National Park Service would establish a monitoring program to determine if and when additional regulations would be needed to protect visitor safety. PWC use could potentially be discontinued in certain areas depending on the results of monitoring.

Personal Watercraft /Swimmer Conflicts — The greatest potential for conflict between PWC users and swimmers is at the high-use areas near Spring Canyon, Porcupine Bay, Fort Spokane, Kettle Falls, and Bradbury Beach. The 200-foot no-wake designation around swim beaches would double the flat wake zone relative to state regulations and would result in a beneficial impact on swimmers at high-use areas.

The remaining park locations would experience little or no conflict between PWC users and swimmers. There are few swimmers in other areas of the park that are frequented by PWC users. Thus conflicts in these segments would constitute negligible adverse impacts.

Personal Watercraft/Other Boat Conflicts — Impacts on other boaters would be similar to alternative A on the majority of the lake – long term, negligible to minor adverse. However, speed restrictions near marinas, launch ramps, and on the stretch of the Spokane Arm near the Two Rivers marina would reduce the potential for conflict with other boaters in these areas. Impact on other boaters in the launch areas and marinas under alternative B would be long-term beneficial.

Overall, PWC use would have a negligible to minor adverse impact on conflicts and safety of boat users within the national recreation area. Management prescriptions would have beneficial impact on conflict and safety on boaters concentrated at high use areas and boat launches.

Personal Watercraft/Other Visitors Conflicts — PWC users and other visitors would interact under alternative B; however, the 200 foot no-wake designations around swim beaches, waterskiers, and persons in the water would result in a long term beneficial impact on other visitors. Shoreline campers would also experience a beneficial impact on safety and conflict issues under this alternative.

Overall, implementation of alternative B would have a beneficial impact on the safety of swimmers.

Cumulative Impacts. Lake Roosevelt and its shoreline are used by a variety of visitors, including swimmers, motorboat users, kayakers, canoeists, campers, anglers, and hikers. All of these user groups interact with each other and occasionally come into conflict. Several of these user groups favor the same general location. Overall use within the national recreation area is expected to increase, and for this reason, the cumulative impact of the various user groups on visitor conflicts and safety under alternative B would be negligible to minor adverse over the short and long term. Planned national recreation area facility improvements would have beneficial impacts on the safety of all visitors, as in alternative A. Cumulative impacts to visitor conflict and safety in tribal managed areas would be the same as in alternative A, as management prescriptions under alternative B would not affect tribal managed areas.

Conclusion. Reinstated PWC use with additional PWC management prescriptions would have short- and long-term beneficial impacts on visitor conflicts and safety near the designated swim areas, boat launches and marinas, and campgrounds and a beneficial impact on other visitors to Lake Roosevelt National

Recreation Area. Cumulative impacts to visitor conflict and safety in tribal managed areas would be the same as in alternative A, as management prescriptions under alternative B would not affect tribal managed areas. Cumulative impacts related to visitor conflicts and safety would be negligible to minor adverse for all NPS user groups in the short and long term, particularly near the high use areas.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no-action alternative personal watercraft would continue to be prohibited from the NPS-managed waters of Lake Roosevelt. Visitors would not be allowed to participate in this form of recreation in the national recreation area, eliminating any conflicts between PWC operators and other recreation area visitors on park service waters. PWC users would be restricted to tribal managed waters and some PWC operators that normally launch from NPS facilities would be displaced to tribal managed launch facilities.

Personal Watercraft / Other Boat Conflicts — No conflict would occur between PWC users and other boaters on park service-managed waters. Thus, impacts on other boaters would be beneficial on park-managed waters. However, it is expected that some PWC users displaced from the national recreation area would access lake waters via the tribal launch ramp at Two Rivers Marina, and recreate on tribal managed waters (see "PWC and Boating Use Trends" section). This would result in an increase in PWC activity on tribal managed sections of the lake, and impacts to other boaters would be minor to moderate adverse at tribal launch ramps and in tribal waters.

Personal Watercraft / Other Visitor Conflicts — Under this alternative, no conflict would occur between PWC users and other visitors in NPS-managed waters and shoreline, as personal watercraft would not be allowed in these areas. Impacts on other visitors would be beneficial in park waters and on park shorelines. However, at tribal launch ramps and on tribal-administered waters and shorelines, PWC conflicts with other visitors could increase because of the relocation of displaced PWC users from NPS waters, assuming PWC users continue to recreate at Lake Roosevelt.

Cumulative Impacts. Cumulative impacts to NPS user groups would be similar to those described for alternative A, but without the contribution from PWC use that would be eliminated from the national recreation area. Conflicts between motorboat users and other non-motorized craft would occur. Cumulative impacts of the various user groups on visitor conflict and safety of NPS visitors would be negligible to minor adverse. PWC use would continue on tribal managed waters and potential safety conflicts would still exist in these areas. Cumulative impacts to user groups of tribal facilities and waters would be similar to those under alternative A. On a regional basis, the no-action alternative would result in a negligible adverse effect to PWC activities on other water bodies in the region as a result of PWC users going to other locations to enjoy this activity.

Conclusion. Personal watercraft would not be reinstated on NPS-managed waters of Lake Roosevelt. Short- and long-term beneficial impacts would result by eliminating visitor conflicts with PWC use and enhancing safety on NPS-administered waters. Long-term minor to moderate adverse impacts on tribal-administered waters would also occur, due to the expected increase of PWC use on these waters. Cumulative impacts of the various user groups on visitor conflict and safety would be negligible to minor adverse.

CULTURAL RESOURCES

GUIDING REGULATIONS AND POLICIES

The NPS primary interest in cultural resources stems from its responsibilities under the following legislation:

> *The NPS Organic Act* — responsibility to conserve the natural and historic objects within parks unimpaired for the enjoyment of future generations
>
> *National Historic Preservation Act* — responsibility to preserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are a living expression of our American heritage
>
> *American Indian Religious Freedom Act* — responsibility to protect and preserve for American Indians access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites
>
> *Archeological Resources Protection Act* — responsibility to secure, for the present and future benefit of the American people, the protection of archeological resources and sites that are on public lands
>
> *Antiquities Act of 1906* — authorized the president to establish historic landmarks and structures as monuments owned or controlled by the United States government. It also instituted a fine for unauthorized collection of artifacts.
>
> *Executive Order 13007* — responsibility to (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites

In accordance the *Management Policies 2001*, the National Park Service must be respectful of these ethnographic resources, and carefully consider the effects that NPS actions may have on them (*Management Policies 2001,* sec. 5.3.5.3).

METHODOLOGY AND ASSUMPTIONS

In this environmental assessment, impacts to cultural resources (archeological resources, historic structures, the cultural landscape, and ethnographic resources) are described in terms of type, context, duration, and intensity, which is consistent with the CEQ regulations. These impact analyses are intended, however, to comply with the requirements of both the *National Environmental Policy Act* and section 106 of the *National Historic Preservation Act* (NHPA). In accordance with the Advisory Council on Historic Preservation's regulations implementing section 106 (36 CFR 800, "Protection of Historic Properties"), impacts to cultural resources were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed on or eligible to be listed on the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed on the national register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the advisory council's regulations a determination of either *adverse effect* or *no adverse effect* must also be made for affected, national register eligible cultural resources. An *adverse effect* occurs whenever

an impact alters, directly or indirectly, any characteristic of a cultural resource that qualify it for inclusion on the national register (e.g., diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur later in time, be farther removed in distance or be cumulative (36 CFR 800.5, "Assessment of Adverse Effects"). A determination of *no adverse effect* means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion on the national register.

CEQ regulations and DO #12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the intensity of an impact from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation only under the *National Environmental Policy Act*. It does not suggest that the level of effect as defined by section 106 is similarly reduced. Although adverse effects under section 106 may be mitigated, the effect remains adverse.

IMPACT ANALYSIS AREA

The impact analysis area for cultural resources is Lake Roosevelt National Recreation Area and the surrounding shoreline area, extending inland to approximately 200 feet. This 200-foot inland segment is assumed to provide a more encompassing range of assessment, based on the distance of PWC operation from the shoreline and the likely distance PWC users would travel inland.

ARCHEOLOGICAL RESOURCES

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archeological resources have the potential to answer, in whole or in part, such research questions. An archeological site(s) can be eligible to be listed on the National Register of Historic Places if the site(s) has yielded, or may be likely to yield, information important in prehistory or history. An archeological site(s) can be nominated to the national register in one of three historic contexts or levels of significance: local, state, or national (see National Register Bulletin #15, *How to Apply the National Register Criteria for Evaluation*). For purposes of analyzing impacts to archeological resources, thresholds of change for the intensity of an impact are based upon the potential of the site(s) to yield information important in prehistory or history, as well as the probable historic context of the affected site(s):

Negligible: The impact is at the lowest level of detection or barely measurable, with no perceptible consequences, either adverse or beneficial, to archeological resources. For purposes of section 106, the determination of effect would be *no adverse effect*.

Minor: Adverse Impact — The impact would affect an archeological site with the potential to yield information important in prehistory or history. The historic context of the affected site(s) would be local. For purposes of section 106, the determination of effect would be adverse effect.

Beneficial Impact — A site would be preserved in its natural state. For purposes of section 106, the determination of effect would be no adverse effect.

Moderate: Adverse Impact — The impact would affect an archeological site with the potential to yield information important in prehistory or history. The historic context of the affected site would be statewide. For purposes of section 106, the determination of effect would be adverse effect.

Beneficial Impact — The site would be stabilized. For purposes of section 106, the determination of effect would be no adverse effect.

Major: Adverse Impact — The impact would affect an archeological site with the potential to yield important information about human history or prehistory. The historic context of the affected site would be national. For purposes of section 106, the determination of effect would be adverse effect.

Beneficial Impact — Active intervention would be taken to preserve the site. For purposes of section 106, the determination of effect would be no adverse effect.

Impairment: A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Lake Roosevelt National Recreation Area; (2) key to the natural or cultural integrity of the national recreation area; or (3) identified as a goal in the national recreation area's general management plan or other relevant NPS planning documents. Project inventories and mitigation would still be conducted. However, without a systematic monitoring program and given the potential access concerns, there would continue to be a risk of some unavoidable adverse impacts.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC use within the national recreation area would have the potential to affect archeological resources by providing visitor access to resources or by causing wave action and erosion. However, potential impacts directly attributable to continued unrestricted PWC use are difficult to quantify. The most likely impact to archeological sites would result from PWC users landing in areas otherwise inaccessible to most other national recreation area visitors and illegally collecting or damaging artifacts. According to park staff, looting and vandalism of cultural resources is not a substantial problem. PWC-induced wave action is also not considered to be a large threat to archeological resources within the recreation area, as most PWC use does not occur during lake drawdowns when resources are most vulnerable. These potential threats could result in minor adverse impacts.

Cumulative Impacts. PWC users, other boaters, and land-based user groups would continue to have access to remote areas with potentially listed archeological sites within the national recreation area. On a cumulative basis all visitor activities could result in minor to major adverse impacts on those resources that are readily accessible, due to the number of visitors and potential for looting or vandalism. Resources in more remote areas that are not as readily accessible to visitors would likely still experience minor adverse impacts on a cumulative basis, but to a lesser degree. All impacts levels would continue at existing levels. Fluctuation in lake levels as a result of spring and late summer drawdowns and other storm events also present a minor to moderate threat of erosion. Spring drawdowns generally occur prior to heavy PWC use; however, drawdowns in late summer do occur during periods of heavy visitation. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of

Indians could experience minor to moderate adverse impacts as a result of PWC and other visitor use for many of the same reasons discussed above.

Conclusion. PWC use within the national recreational area could have minor adverse impacts on listed or potentially listed archeological sites from possible illegal collection and vandalism or from erosion due to PWC-induced wave action. Cumulative impacts from other visitor use on archeological resources that are readily accessible could be minor to major adverse, due to the number of visitors and the potential for illegal collection or destruction. Lake fluctuations would also potentially cause minor to moderate impacts through erosion. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians would be similarly affected and could experience minor to moderate adverse impacts as a result of PWC and other visitor use. All impacts would occur over the short and long term.

Implementation of this alternative would not result in an impairment of cultural resources.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Impacts to archeological resources would be similar to those under alternative A, although creation or extension of flat-wake restrictions would reduce PWC-induced wave action, resulting in some beneficial impact. Project by project inventories and a monitoring program would determine if and when additional regulations would be necessary to protect cultural resources, resulting in minor to moderate beneficial impacts. Long-term impacts to archeological resources would continue to be minor.

Cumulative Impacts. Visitor activities, such as motorized boating could result in minor to major cumulative adverse impacts on those resources that are readily accessible, due to the number of visitors and the potential for looting or vandalism. Lake fluctuations would also potentially cause minor to moderate impacts through erosion. All impact levels would continue at existing levels, with lower impacts in areas with flat-wake restrictions. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians would be similarly affected and could experience minor to moderate adverse impacts as a result of PWC and other visitor use for many of the same reasons discussed above.

Conclusion. Although flat-wake restrictions within the national recreation area would reduce wave action in some areas and provide a minor beneficial impact, PWC use could have minor adverse impacts on listed or potentially listed archeological resources from possible illegal collection and vandalism, similar to alternative A. In unrestricted areas, PWC-induced wave action could also have minor adverse impacts on listed or potentially listed archeological sites from erosion. Cumulative impacts from visitor activities on archeological resources that are readily accessible could be minor to major and adverse, due to the number of visitors and the potential for illegal collection or destruction. Lake fluctuations would also potentially cause minor to moderate impacts through erosion. Continuing PWC use under a special regulation is not expected to negatively affect the overall condition of cultural resources due to resource monitoring that would be conducted. Archeological resources in areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians could experience minor to moderate adverse impacts as a result of PWC and other visitor use. All impacts would occur over the short and long term.

Implementation of this alternative would not result in an impairment of cultural resources.

Impacts of the No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under this alternative PWC use would be discontinued within the national recreation area eliminating impacts to archeological sites from PWC use within NPS-managed waters.

Cumulative Impacts. Although impacts from PWC use within the national recreation area would be eliminated, the effects of other watercraft users and land-based user groups would still have the potential for minor to major adverse cumulative impacts within the national recreation area. On a cumulative basis, potential visitor impacts from illegally collecting or damaging resources that are readily accessible would continue. Resources in more remote areas that are not as readily accessible to park visitors would likely still experience minor adverse impacts, but to a much less degree. While PWC use would be prohibited within areas of NPS jurisdiction under this alternative, PWC use within areas managed by the Colville Confederated Tribes and Spokane Tribe of Indians could continue. This continued PWC use in addition to other visitor use could result in minor to moderate adverse impacts to archeological resources within areas of tribal jurisdiction.

Conclusion. Prohibiting PWC use would result in minor beneficial impacts over the short and long term on archeological sites within the national recreation area. Cumulative impacts from all other visitor activities would continue to be minor to major, depending on the accessibility of the resource and the potential for illegal collection or damage. Lake fluctuations would also continue to cause minor to moderate impacts through erosion. Tribal archeological resources would continue to experience minor to moderate cumulative effects from PWC and other visitor use. All impacts would occur over the short and long term.

SOCIOECONOMIC EFFECTS

This section summarizes the socioeconomic impacts associated with the proposed alternatives for PWC use in Lake Roosevelt National Recreation area. A detailed description of these impacts and a complete list of references are provided in the report “Economic Analysis of Personal Watercraft Regulations in Lake Roosevelt National Recreation Area” (LAW et al. 2002). A Benefit Cost Analysis of the alternatives is also included.

ECONOMIC IMPACT ANALYSIS

Lake Roosevelt National Recreation Area experiences relatively low rates of PWC visitation. Personal watercraft make up only approximately 4% of motorized watercraft that recreate on Lake Roosevelt. There are other destinations in the area that are more popular with PWC users such as Lake Chelan and the Columbia River. It is assumed that many PWC users who currently visit Lake Roosevelt would either continue to use waters on the lake that are under tribal administration or choose to visit nearby lakes. No PWC sales or rental shops are located on the banks of Lake Roosevelt, though the nearest rental facility is located on Banks Lake only 3 miles away.

The primary economic impacts associated with the proposed PWC restrictions would be potential reductions in the sales, profits, and employment of businesses that serve PWC users visiting the park. The total regulatory cost of each alternative would depend on how the affected individuals and firms responded to changes under the no-action alternative. To the extent that affected local retailers could provide substitute products and services, they might be able to reduce any negative impact on their profits. For instance, some current PWC users might continue to visit the park to participate in other

recreational activities, which would decrease the financial impact on local businesses. It is also possible that visitation by non-PWC users to the national recreation area would increase following prescriptions on PWC use if the prescriptions made park visitation more enjoyable for other users. The most popular visitor activities at the recreation area are fishing and camping, and PWC regulations would not deter visitors from participating in these types of activities. Therefore no effects to lodging establishments, restaurants, or other tourism related businesses at Lake Roosevelt would be expected from PWC regulations.

BENEFIT-COST ANALYSIS

The purpose of benefit-cost analysis is to determine whether an alternative would promote an efficient allocation of resources; this is whether the proposed action would generate more benefits than costs. These costs and benefits accrue directly to households that use personal watercraft, and indirectly to those who are affected by PWC use (e.g., those who would benefit from reduced noise). The resulting changes in PWC use could also impose costs on those who own or work for PWC-related businesses.

Even individuals who are not visitors of this national recreation area (i.e., nonusers) could benefit from the knowledge that the resources are being protected and preserved. In other words, they may hold positive "nonuse values" for protecting the national recreation area's environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for the protection of the national recreation area's resources is provided in the economics literature. Restrictions on PWC use in the national recreation area could therefore provide benefits to both users and nonusers in a number of ways by protecting the national recreation area's ecological resources.

For purposes of this analysis, six major affected groups have been identified and listed in table 34 along with the anticipated impacts of the proposed regulatory alternatives. The following definitions apply:

> *Consumer surplus* - the economic measure of net benefits that accrue to individuals from PWC use and the appreciation of the Lake Roosevelt's resources.
>
> *Producer surplus* - the economic measure of net benefits that accrue to businesses that sell or rent PWC and other related businesses. Producer surplus is generally equivalent to business profit.

Increases in consumer surplus and producer surplus represent benefits, while decreases in those measures represent costs.

This analysis of benefits is largely qualitative since quantification of all benefits and costs was not feasible with currently available data. The primary beneficiaries of alternatives B and the no-action alternative would be visitors to the national recreation area who do not use personal watercraft and whose experience would be adversely affected by the presence of personal watercraft. Non-PWC users have expressed concern about PWC use in the national recreation area, suggesting that PWC use does have a negative impact on at least some visitors.

Nonusers would also be likely to benefit from the proposed measures. For example, individuals who do not visit the National Recreation Area could benefit simply from the knowledge that the natural resources of the national recreation area are being protected. Therefore, some of the benefit categories described below, in particular those associated with the preservation of unique national recreation area resources and ecosystems, would accrue in the form of nonuse values.

TABLE 34: IMPACTS OF ALTERNATIVES ON USER GROUPS

User Group	Alternative A: Reinstate PWC Use under a Special NPS Regulation as Previously Managed	Alternative B: Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)	No-Action Alternative: Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt
1. PWC users	No change in consumer surplus.	No change in consumer surplus.	Consumer surplus is expected to decrease for both current users and those who may wish to visit in the future as a result of the ban on PWC use in the park.
2. Other visitors or potential visitors: canoe users, anglers, other boaters, swimmers, hikers and other visitors	No change in consumer surplus.	Consumer surplus is expected to increase slightly because noise and disturbance from personal watercraft will be reduced with flat-wake zoning, but this effect will be minimal due to the large number of other motorized watercraft present in the park as well as in adjacent waters controlled by Indian tribes.	Increases in consumer surplus similar to, but larger than, benefits realized under alternative B. Consumer surplus is expected to increase for new visitors who would not have visited the park without these restrictions on PWC use.
3. Producers of PWC services: PWC rental shops, PWC sales shops, and other parts of the local economy providing services to PWC users	No change in producer surplus.	No change in producer surplus.	PWC rental shops are expected to experience a decline in producer surplus. Producer surplus for PWC dealerships is expected to decrease as a result of a decline in sales and servicing of personal watercraft. Other parts of the local economy such as hotels, restaurants, and gas stations located near the park are not expected to have a measurable decline in producer surplus.
4. Local residents of the area surrounding the park	No change in welfare.	No change in welfare.	Local residents who use personal watercraft may experience a small decline in welfare due to a ban of personal watercraft in the park although they will still be able to access the remainder of the park. Local residents who do not use personal watercraft may experience an increase in welfare as a result of a decline in noise, increased water quality, and a decrease in the risk of accidents involving personal watercraft.
5. Producers of services for visitors to the park who do not use personal watercraft	No change in producer surplus.	Producer surplus might increase slightly because more people may visit the park for alternative activities if the noise and disturbance from personal watercraft are reduced, but this effect will be mitigated by the large number of other motorized watercraft present in the park as well as in adjacent waters controlled by Indian tribes.	Producer surplus is expected to increase somewhat more than under alternative B as demand for activities such as camping and boating might increase if visitors do not have to share grounds and boat launches with personal watercraft.
6. The general public who may care about the natural resources in the park even if they do not visit	No change in welfare.	A slight increase in welfare due to protection of resources through implementation of resource monitoring.	May experience an increase in welfare as a result of enhanced nonuse values resulting from increased environmental quality, although this effect is mitigated by the presence of personal watercraft in parts of the park outside NPS jurisdiction.

COSTS TO PWC USERS

Two groups of PWC users would be affected by the proposed regulations: users who currently ride in the national recreation area and users who ride personal watercraft in other areas outside the park where those displaced may decide to ride if PWC use in the park was restricted.

For PWC users who currently ride or who want to ride in the national recreation area in the future, prohibiting or restricting PWC use in the national recreation area could result in consumer surplus losses, an adverse effect. To the extent that individuals consider the utilization of other nearby PWC areas, the loss in consumer surplus associated with prescription PWC use in the national recreation area would be reduced.

PWC users who currently ride in nearby areas could be displaced by riders from the national recreation area and would be adversely affected if these areas subsequently became more crowded. Although no studies were available that examine the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience.

The estimated impact of each proposed alternative on PWC users is discussed below.

Alternative A: Alternative A would have no effect on any of the user groups relative to conditions prior to the November 2002 ban on personal watercraft in NPS-administered portions of Lake Roosevelt. Consumer surplus to PWC riders would remain unchanged.

Alternative B: Under this alternative, it is anticipated that decrease in PWC use as a result of the regulation would be essentially zero. The implementation of flat-wake zones and resource monitoring as management strategies would not affect the number of visitors to the lake that use personal watercraft.

No-Action Alternative: The no-action alternative would result in a continued prohibition on PWC use in the national recreation area. PWC users would experience a moderate, short and long-term, adverse effect (decrease) on the full value of their consumer surplus for PWC use in the national recreation area. However, PWC use would continue in waters of Lake Roosevelt administered by the Spokane Tribe and Confederated Tribes of the Colville Reservation, offsetting some of the anticipated impact to consumer surplus.

COSTS TO THE LOCAL AREA BUSINESSES

If PWC use decreases as a result of the restrictions, then the suppliers of PWC sales and rental services would be adversely affected. It is unlikely that the proposed restrictions would have substantial impacts on the sales shops because they are located 60 to 100 miles away from the national recreation area and nearby substitute areas are more popular locations for PWC use.

PWC sales and rental shop losses would only be expected to occur under the no-action alternative. NPS estimates of the producer surplus loss to PWC sales shops ranges from $1,740 to $39,990 based on estimated reductions in national recreation area-related PWC revenue of 5% to 15%. NPS estimates no change in producer surplus to PWC rental shops for alternatives A and B. For the no-action alternative, producer surplus losses to PWC rental shops would range from $70 to $480 based on estimated reductions in national recreation area-related PWC rental revenue of 5% to 15%.

PWC users comprise a small fraction of total visitation to Lake Roosevelt and even if PWC use is banned in the national recreation area, the use of PWC would still be allowed in waters under administration by

adjacent tribal entities. Lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a substantial reduction in business under any of the alternatives.

ENVIRONMENTAL JUSTICE

This section summarizes the potential impacts in regard to environmental justice associated with the proposed alternatives for PWC use in Lake Roosevelt National Recreation Area.

Impacts related to environmental justice have been analyzed qualitatively using professional judgment to define thresholds or impact magnitude.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC users at the national recreation area represent a cross-section of ethnic groups and income levels from the surrounding counties. Under this alternative all PWC user groups would continue to have access to all areas of the lake, except those closed to motorized watercraft use. There would be no conflicts as both NPS- and tribal-managed waters would be open to PWC use by all ethnic groups and income levels. Adverse impacts from PWC use would be negligible since reinstatement of use within the national recreation area would not disproportionately affect minority or low income populations.

Recreational use facilities managed by the Indian Tribes including marina facilities, fueling, launch ramps, and campgrounds would continue to be available, providing recreational opportunities and equipment support to PWC users operating on both NPS and tribal waters under alternative A. There would be a long-term beneficial economic impact to tribal managed facilities on reservation lands from the reinstatement of PWC use under this alternative.

Cumulative Impacts. Under this alternative, PWC use would be reinstated to all waters within the national recreation area, except Crescent Bay Lake, which is closed to all motorized watercraft use. Reduced conflicts with other watercraft would result from the dispersion of PWC use from tribal waters to include other areas of the lake, making facilities at Keller Ferry, Seven Bays, Two Rivers, and Kettle Falls available for PWC launching, fueling and parking. This action would not be in conflict with other motorized boat use since PWC use represents only 4% of all boat use on Lake Roosevelt. There would be a long-term beneficial impact to tribal managed marina facilities on NPS-administered lands from the reinstatement of PWC use under this alternative.

Conclusion. There would be no adverse effects related to environmental justice since reinstating PWC use within the national recreation area would not disproportionately affect minority or low income populations. Recreational use facilities managed by the Indian Tribes would continue to be available to PWC users, providing long-term beneficial impacts to tribal managed facilities on both NPS and tribal lands from the reinstatement of PWC use. Reduced conflicts with other watercraft would result from the dispersion of PWC use from tribal waters to other areas of the lake, resulting in a long-term beneficial impact.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Under alternative B, PWC use would be managed using additional management prescriptions including flat wake speed zoning and resource monitoring. These additional management prescriptions would be applicable within NPS-managed waters of Lake Roosevelt, and for all PWC users regardless of ethnic group or income level. As a result, impacts would be the same as for alternative A and there would be no adverse effects related to environmental justice, but there would be long-term beneficial effects to tribal managed facilities on reservation lands.

Cumulative. Impacts would be the same as for alternative A, resulting in long-term beneficial economic impacts to tribal managed facilities on NPS-administered lands.

Conclusion. Impacts related to environmental justice, both adverse and beneficial, would be the same as for alternative A and there would be no adverse effects related to environmental justice since reinstating PWC use within the national recreation area would not disproportionately affect minority or low income populations. Recreational use facilities managed by the Indian Tribes would continue to be available to PWC users, providing long-term beneficial impacts to tribal managed facilities on both NPS and tribal lands from the reinstatement of PWC use. Reduced conflicts with other watercraft would result from the dispersion of PWC use from tribal waters to other areas of the lake, resulting in a long-term beneficial impact.

Impacts of No-Action Alternative — Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Under the no action alternative, the ban on PWC use would continue within NPS-managed waters of Lake Roosevelt. PWC users would be required to launch from the Two Rivers Marina on shoreline managed by the Spokane Tribe of Indians. Conflicts between PWC users and other watercraft could occur, as displaced personal watercraft begin to use parking, launching, fueling, and docking facilities. This could result in a long-term negligible to minor adverse impact from an increase in the Tribe's management, enforcement responsibilities and related costs. However, minor beneficial economic effects to the Spokane Tribe would also be possible from an increase in PWC users purchasing fuel and other supplies from the Two Rivers Marina.

Displacement of PWC use onto the tribal side of the lake could also increase landing activities, access, and illegal camping along the undeveloped shorelines of both reservations, potentially increasing disturbance to culturally sensitive areas and native habitat as PWC use concentrates within the region. There would be a long-term negligible to minor adverse impact to tribal managed lands and waters from the continued prohibition of PWC use under this alternative.

Cumulative. Since personal watercraft would not be allowed on recreation area waters, marina facilities on NPS-administered lands that are managed by the Confederated Colville Tribes would experience minor to moderate adverse effects from loss of revenue from PWC users. The Keller Ferry and Seven Bays marinas would potentially experience minor to moderate adverse impacts related to revenue loss.

Conclusion. Under the continued prohibition of PWC use on NPS-managed waters, PWC use would be displaced onto the tribal side of the lake, potentially resulting in negligible to minor adverse impacts on tribal enforcement costs. Minor beneficial impacts could result from PWC users' increased spending at the Two Rivers Marina. Displacement of PWC use could also increase disturbances to naturally and culturally sensitive areas, resulting in a long-term negligible to minor adverse impact to tribal managed

lands and waters. Minor to moderate adverse impacts could also affect the marinas on NPS-managed lands that are managed by the Confederated Tribes of the Colville Reservation.

NATIONAL RECREATION AREA MANAGEMENT AND OPERATIONS

CONFLICT WITH STATE AND LOCAL PWC ORDINANCES AND POLICIES

Some states and local governments have taken action, or are considering taking action, to limit, ban, and otherwise manage PWC use. While a national park system unit may be exempt from these local actions, consistency with state and local plans must be evaluated in accordance with NEPA.

Impacts related to conflicts with state, tribal and local ordinances have been analyzed qualitatively using professional judgment to define thresholds or impact magnitude.

Because of the split jurisdiction on Lake Roosevelt where control of the water surface is divided between the National Park Service and two Indian Tribes, it is incumbent upon the National Park Service to develop rules that are consistent with the managing partners to the degree possible in order to facilitate understanding and compliance by the boating public and enforcement by the managing entities. Neither tribe has indicated that they intend to adopt rules pertaining to personal watercraft at this time. Unilateral adoption of rules by the National Park Service that differ from rules applicable to other portions of the lake without good cause would be counter to the objective of "seamless" management of the water surface and would likely not be supported by the tribal governments, local governments or large segments of the general public.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. PWC users at the national recreation area would be required to follow all applicable state boating regulations, as well as NPS regulations. Under this alternative NPS rangers would enforce all state boating regulations within the recreation area. There would be no conflicts between park regulations and other regulations such as those enforced on waters of Lake Roosevelt that are under jurisdiction of the Spokane Tribe of Indians and the Confederated Tribes of the Colville Reservation as the two tribes also follow the state boating regulations. Adverse impacts for alternative A would be negligible since no conflicts with state or tribal regulations would occur.

Cumulative Impacts. Personal watercraft are not prohibited at any location within the body of Lake Roosevelt under this alternative except as specified under the state boating regulations. Crescent Bay Lake would continue to be the only area within the recreation area that is closed to all motorized watercraft including personal watercraft. Implementation of alternative A would not be in conflict with existing tribal, local or state policies or regulations. Cumulative adverse impacts would be negligible under this alternative since management of PWC use would not be in conflict with state or local regulations.

Conclusion. Under this alternative, management of PWC regulations within the national recreation area would include NPS and state regulations. Waters adjacent to the recreation area are under the jurisdiction of the Confederated Tribes of the Colville Reservation and the Spokane Tribe of Indians. Reinstated PWC use under alternative A would be managed as it was prior to the ban in November of 2002 and would not result in conflicts with state or tribal regulations. Therefore, adverse impacts (including cumulative impacts) would be negligible.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. PWC use under alternative B would be managed under current state boating regulations with additional management prescriptions included as a part of this alternative. These management strategies are more restrictive than state PWC regulations and include flat-wake speed zoning and resource monitoring. The prescriptions are within the NPS legal mandate to regulate recreational activities under their jurisdiction, and there would be no conflict with state or other federal policies or regulations. Conflicts with regulations and policies of the Spokane Tribe of Indians and the Confederated Tribes of the Colville Reservation would exist due to differences in restrictions on the National Park Service versus tribal waters.

Cumulative Impacts. Waters adjacent to the NPS-managed waters of Lake Roosevelt are under tribal jurisdiction and would not be included in the prescriptions implemented for PWC use on NPS-administered waters under this alternative. This could potentially cause some confusion to PWC users because of the difference in regulations within the same body of water. Adverse impacts related to conflicts with tribal requirements or policies would be negligible to minor. Conflicts would not occur with other entities such as federal, state, or local regulations and adverse impacts related to such conflicts would be negligible.

Conclusion. PWC management prescriptions under alternative B would apply only within the recreation area's NPS jurisdictional boundary and would differ from tribal regulations in adjacent waters. These conflicts with tribal PWC regulations would potentially cause negligible to minor adverse impacts, mainly to PWC users and enforcement staff on Lake Roosevelt. There would be no conflict with other federal, state, or local PWC regulations or policies, and adverse impacts would be negligible.

Impacts of No-Action Alternative — Continue Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. The no-action alternative would continue the ban on PWC use within NPS-administered waters of Lake Roosevelt. The National Park Service has the legal mandate to regulate the types of activities that take place under its jurisdiction. State PWC regulations do not have provisions that restrict additional controls or bans on PWC use, thus the implementation of additional restrictions would not be in conflict with state regulations or policies. The no-action alternative would not be in conflict with other federal or state regulations or polices. The alternative would however, be in conflict with policies on adjacent waters under tribal jurisdiction, as PWC use would continue to be allowed on waters of Lake Roosevelt administered by the Spokane and Confederated Colville Tribes.

Cumulative Impacts. All other areas surrounding Lake Roosevelt National Recreation Area where PWC use takes place are subject to state regulations and may also follow local policies and regulations. Under the no-action alternative, conflicts would not occur with state or local regulations or policies at surrounding reservoirs, as PWC use would continue to be allowed in these areas. Cumulative adverse impacts resulting from such conflict would be negligible. PWC use would continue to be allowed on tribal waters adjacent to NPS-managed waters in Lake Roosevelt. This conflict would cause minor to moderate adverse impacts to PWC users and NPS enforcement staff.

Conclusion. Continuing the ban on PWC use within NPS-managed waters of Lake Roosevelt would not result in conflict with state or local PWC regulations or policies at surrounding water bodies where PWC use occurs. Therefore, adverse impacts related to such conflicts (including cumulative impacts) would be negligible. However, minor to moderate adverse impacts would occur due to conflict with tribal policies

on Lake Roosevelt. PWC use would continue to be allowed on tribal waters while a ban would be enforced on adjacent NPS-administered waters and facilities.

IMPACT TO PARK OPERATIONS FROM INCREASED ENFORCEMENT NEEDS

Impacts to park operations from increased enforcement needs related to PWC use have been analyzed qualitatively using professional judgment to define thresholds or impact magnitude.

Impacts of Alternative A — Reinstate PWC Use under a Special NPS Regulation as Previously Managed

Analysis. Reinstating PWC use within the national recreation area would occur using existing NPS boat patrols, with the assumption that PWC users would sometimes operate illegally within the recreation area (such as violating flat-wake speed zones). Staffing needs would remain at current levels and enforcement requirements would not change.

Cumulative Impacts. Motorboat users, swimmers, PWC operators, sea kayakers and canoeists all use the reservoir shoreline. Park enforcement staff would continue to provide assistance to these user groups to resolve conflicts and ensure safety. Park operations and enforcement needs for these groups would be the same as for existing conditions, since the number of people and boats would not change under this alternative. Non-PWC boating activities would continue to make up over 95% of motorized vessels on the lake and would create larger demands on enforcement staff than PWC use. NPS staff has previously requested funding to increase enforcement staff for all visitor activities, but securement of these funds is not certain.

Conclusion. This alternative would have negligible adverse impacts on park operations and enforcement would continue at current levels.

Impacts of Alternative B — Reinstate PWC Use under a Special NPS Regulation with Additional Management Prescriptions (Preferred Alternative)

Analysis. Reinstating PWC use within the recreation area with management prescriptions such as increased flat-wake zoning and resource monitoring would require increased education and enforcement actions by park staff. It is assumed that some PWC users would operate illegally, and park staffing would continue at current levels.

Cumulative Impacts. Cumulative impacts would be similar to those described for alternative A. Non-PWC boating activity would continue to place higher demands on enforcement staff than personal watercraft. Additional education material or programs would be required to inform the public of new PWC management prescriptions within park waters of Lake Roosevelt.

Conclusion. Alternative B would have negligible to minor adverse impacts on park operations. Staffing would continue at current levels, though increased enforcement efforts would be required to implement flat-wake zoning. Additional educational efforts would also be required to inform PWC users of new regulations.

Impacts of No-Action Alternative — Continue the Prohibition of PWC Use on NPS-Managed Waters of Lake Roosevelt

Analysis. Continuation of the ban on PWC use on NPS-administered waters within Lake Roosevelt would reduce potential conflicts between PWC recreationists and other user groups, but park staff would be required to increase visitor education and enforcement. Signs and information programs would be required at the existing launch areas to indicate PWC use restrictions. Enforcement of the no-action alternative would be problematic since PWC use would continue to be allowed on the adjacent waters under tribal jurisdiction. Enforcement actions to ensure compliance with PWC use restrictions would be completed using the existing irregular boat patrols, with the assumption that PWC users would sometimes operate illegally, either knowingly or unknowingly, within the recreation area.

Cumulative Impacts. Cumulative impacts would be similar to alternative A as non-PWC activities would continue. Enforcement would be conducted with existing staff and boat patrols. Recreation area enforcement staff may increase due to funding requests already submitted by the park, but this is not yet known. Due to the discrepancy of PWC use on NPS and tribal waters, enforcement of a PWC ban within Lake Roosevelt National Recreation Area would be challenging, especially with no assurance of an increase in enforcement staff.

Conclusion. This alternative would have minor to moderate adverse impacts on park operations. No additional staff, funding, or equipment beyond what has been requested would be secured to ensure compliance with the PWC ban and to regulate existing boating use. Staff would initially need to spend more time and effort educating visitors until they became fully aware of the PWC ban. Under the no-action alternative, it would be likely that some PWC users would operate illegally within the recreation area.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are impacts that cannot be avoided and cannot be mitigated, and therefore would remain throughout the duration of the action. The following list describes potential adverse impacts related to the alternatives being considered:

- PWC use would cause pollutant emissions into lake water and air under alternatives A and B. These impacts would decrease in the long term due to the required improvements in engine emission technology.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY TO ACHIEVE SHORT-TERM GAIN

None of these resources would be impacted to the point of impairment or long-term permanent loss.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irretrievable commitments of resources are those that can be reversed; that is, the commitment of a renewable resource or the short-term commitment of any resource. These include the commitment of water quality and air quality by allowing all mobile sources desiring to do so, including personal watercraft, to continue using the national recreation area under alternatives A and B. The use of fossil fuels to power personal watercraft would be an irretrievable commitment of this resource; however, this use is minor.

CONSULTATION AND COORDINATION

Various management issues regarding boating and PWC use were discussed throughout the development of the most recent *General Management Plan* for the recreation area from 1997 completing in 2000. Lake users, local and tribal governments, conservation interests, the state's Congressional delegation and the general public were consulted extensively throughout development of the GMP in public meetings, newsletters, and the draft and final GMP and associated Environmental Impact Statement. The majority of people expressed that the level of boating and the quality of the experience were satisfactory and that no substantive management changes were necessary. A portion believed that there are too many people who do not respect the regulations and create safety problems by speeding and operating their crafts in an unsafe manner. They expressed the opinion that the National Park Service should increase enforcement.

In summary, most people indicated that despite some problem areas, the level of boating activity was acceptable and that, due to the size of the reservoir, there was still room for visitors to seek and find different types of experiences. Noise was a concern in confined spaces such as in the Spokane Arm of the lake. The predominant sentiment expressed by the public regarding PWC use on Lake Roosevelt was that the park should educate first and regulate as needed. The Record of Decision continued to allow PWC use subject to additional controls as needed.

To initiate the public scoping process the park issued a Notice of Proposed Rulemaking Related to the Use of Personal Watercraft at Lake Roosevelt on June 18, 2001. A press release was issued on June 21, 2001 that generated articles in local papers including the Spokane Spokesman-Review. Articles on the rulemaking were also included in the August 2001 Lake Roosevelt Forum newsletter, which is distributed to over 2,000 people. The park's Summer 2001 newspaper, distributed at all launch ramps and campgrounds, also contained information on the issue. Because of the extensive discussions regarding PWC use that occurred during the development of the GMP, public meetings during the scoping phase of the rulemaking were not scheduled.

From 1998 to 2003, 702 written comments concerning personal watercraft have been received by the park. Topics of concern have included safety, noise, and environmental effects of PWC use. Of those indicating support of PWC use on the reservoir, many are in favor of quieter, less polluting machines, and implementing some restrictions such as flat-wake zones in sensitive areas. Those indicating opposition to PWC use in the recreation area cite noise, reckless behavior, and pollution as reasons to prohibit the watercraft.

CONSULTATION WITH OTHER AGENCIES

Request for consultation letters have been sent to various agencies such as the U.S. Fish and Wildlife Service, Bureau of Reclamation, and the Tribes associated with the reservoir. Comments from these agencies may be received during the public review and comment period. An example of the request for consultation letters is included in appendix B.

The distribution list for this document includes federal, state, tribal and local agencies as well as adjacent landowners, interest groups and the public at large.

REVIEWING AGENCIES FOR THE ENVIRONMENTAL ASSESSMENT

The following agencies, tribes, groups, and organizations were sent requests for consultation, and will receive a copy of this *Environmental Assessment*. There may be additional businesses and individuals not

included on this list that will also be sent a copy of the document due to expressed interest in the document.

FEDERAL AGENCIES

Department of Agriculture

Forest Service

Colville National Forest

Okanogan National Forest

Okanogan-Wenatchee National Forest

Department of the Interior

Bureau of Land Management

Bureau of Indian Affairs

Bureau of Reclamation

National Park Service

Daisy Station

Pacific West Regional Office

Regional Solicitor's Office

North Cascades National Park

U.S. Fish and Wildlife Service Little Pend Oreille National Wildlife Refuge

Department of Justice

Assistant U.S. Attorney

U.S. Marshal

Department of Transportation

U.S. Coast Guard Auxiliary

U.S. Environmental Protection Agency

U.S. Senate

Native American Tribes

Colville Confederated Tribes

Colville Tribal Enterprise Corporation

Colville Tribal Museum

Colville Tribal Parks and Recreation

Spokane Tribe of Indians

Spokane Tribal Business Council

Spokane Tribal Fish Hatchery

Spokane Tribal Historic Preservation Office

State Agencies

Governor's Council on Environmental Education

Washington Department of Ecology

Washington Department of Fish and Wildlife

Washington Department of Natural Resources

Washington Office of Archeology and Historic Preservation

Washington State Historical Society

Washington State Parks and Recreation Committee

Washington State Tourism

Local and Regional Agencies

Avista

Bonneville Power Administration

Chelan County PUD Parks

City of Colville

Chamber of Commerce

Confederated Business Council

City of Davenport

City of Grand Coulee

City of Kettle Falls

Ferry County

Commissioners

County Planner

Fire District #3

Sheriff Department

Grand Coulee

Dam Area

Fire Department

Grant County

Commissioners

Sheriff Department

Hanson Harbor Water Association

Kettle Falls

- Chamber of Commerce
- Fire Department

Lake Roosevelt Forum

Lake Roosevelt Water Quality Council

Law Enforcement Coordinator

Lincoln County

- Commissioners
- Fire Departments
- Planning Department
- Public Works
- Sheriff

Northwest Power Planning Council

Northwest Tri County Health District

Stevens County

- Commissioners
- Federal Lands Advisory Committee
- Fire Departments
- Planning Department
- Sheriff Department
- Town of Coulee Dam
- Town of Creston
- Town of Wilbur

Organizations and Businesses

- Bluewater Network
- Camp Na Bor Lee Association
- Cayuse Cove Homes Association
- Corkscrew Canyon Association
- Federal Lands Advisory Committee
- Grand Coulee Dam Yacht Club
- Hellgate Youth Camp

Lake Roosevelt Boat Club
Lake Roosevelt Development Association
Lake Roosevelt Property Owners Association
Lake Roosevelt Vacations
Lincoln RV Park
Moccasin Bay Dock Association
National Parks and Conservation Association
North Cascades Conservation Council
North Central Washington Audubon
North Lake Roosevelt Boater's Co-Op
Personal Watercraft Industry Association (PWIA)
Public Lands Council
Rantz Marine Park Association
Rantz Marine Park Improvement Association
Republic New Miner
Rickey Point Sailing Club
Riverview Area Association
Riverwood Cove Association
Roosevelt Recreational Ent.
Save Our Shoreline
Sherman Creek Hatchery
Sierra Club
Spokane Canoe and Kayak Club
Sunset Point Association
The Mountaineers
The Nature Conservancy
The Wilderness Society, Pacific Northwest Region
Two Rivers Casino and Shoreline Park
Upper Columbia Yacht Club

APPENDIX A: APPROACH TO EVALUATING SURFACE WATER QUALITY IMPACTS

Objective

Using simplifying assumptions, estimate the minimum (threshold) volume of water in a reservoir or lake below which concentrations of gasoline constituents from personal watercraft or outboards would be potentially toxic to aquatic organisms or humans. Using the estimated threshold volumes, and applying knowledge about the characteristics of the receiving waterbody and the chemical in question, estimate if any areas within the waterbody of interest may present unacceptable risks to human health or the environment.

Overall Approach

Following are the basic steps in evaluating the degree of impact a waterbody (or portion of a waterbody) would experience based on an exceedance of water quality standards / toxicity benchmarks for PWC- and outboard-related contaminants.

1. Determine concentrations of PAH, MTBE in gasoline (convert from weight percent to mg/L, as needed), and PAH in exhaust. The half-life of benzene in water is 5 hours at 25°C (Verschuren 1983; EPA 2001).

2. Estimate loading of PAH, benzene, and MTBE for various appropriate PWC-hour levels of use for one day (mg/day)

3. Find/estimate ecotoxicological and human health toxicity benchmarks (risk-based concentrations) (micrograms [µg]/L) for PAH, benzene, and MTBE.

4. Divide the estimated loading for each constituent (µg) by a toxicity benchmark (µg/L) to determine the waterbody threshold volume (L) below which toxic effects may occur (convert liters to acre-feet).

Estimated hydrocarbon (HC) emissions from personal watercraft and outboards will be significantly reduced in the near future, based on regulations issued by the Environmental Protection Agency and the California Air Resources Board.

Assumptions and Constants

Several assumptions must be made in order to estimate waterbody threshold volumes for each HC evaluated. Each park should have park-specific information that can be used to modify these assumptions or to qualitatively assess impacts in light of park-specific conditions of mixing, stratification, and the characteristics of the chemicals themselves. The assumptions are as follows:

- BTEX are volatile and do not stay in the water column for long periods of time. Because benzene is a recognized human carcinogen, it is retained for the example calculations below and should be considered in each environmental assessment or environmental impact statement (Verschuren 1983; EPA 2001).

- MTBE volatilizes slightly and is soluble in water. MTBE may accumulate in water from day to day, but this is not factored into the calculation and should be considered qualitatively in the assessment.

- PAH volatilize slightly (depending on structure and molecule size) and may adhere to sediment and settle out of the water column or float to the surface and be photo-oxidized. They may accumulate in water from day to day, but this is not factored into the calculation and should be considered qualitatively in the assessment.

- The toxicity of several PAH increases (by several orders of magnitude) when the PAH are exposed to sunlight. This was not incorporated because site-specific water transparency is not known, and should be discussed qualitatively.

- The threshold volume of water will mix vertically and aerially with contiguous waters to some extent, but the amount of this mixing will vary from park to park and location to location in the lake, reservoir, river, or other waterbody. Therefore, although the threshold volume calculation assumes no mixing with waters outside the "boundary" of the threshold volume of water, this should be discussed in the assessment after the threshold volume is calculated. The presence or absence of a thermocline should also be addressed.

- Volume of the waterbody, or portion thereof, is estimated by the area multiplied times the average depth.

In addition to these assumptions, several constants required to make the calculations were compiled from literature and agency announcements. Gasoline concentrations are provided for benzene, MTBE and those PAH for which concentrations were available in the literature. Constants used are:

- Gasoline emission rate for two-stroke personal watercraft: 3 gal/hour at full throttle (CARB 1998)

- Gasoline emission rate for two-stroke outboards: estimated at approximately the same as for personal watercraft for same or higher horsepower outboards (80–150 hp); approximately twice that of personal watercraft for small (e.g., 15 hp) outboards. (Note: Assume total hours of use for the various size boats/motors, and that smaller 15 hp motors that exhaust relatively more unburned fuel would probably be in use for a much smaller amount of time than the recreational speedboats and personal watercraft). This estimate is based on data from Allen et al. 1998 (Figure 5). It is noted that other studies may indicate different relative emission rates (e.g., about the same emissions regardless of horsepower, or larger horsepower engines having higher emission rates than smaller engines [CARB 2001]). The approach selected represents only one reasonable estimate.

- 1 gallon = 3.78 liters

- Specific gravity of gasoline: 739 g/L

- 1 acre-foot = 1.234×10^6 L

- Concentration of benzo(a)pyrene (B[a]P) in gasoline: up to 2.8 mg/kg (or 2.07 mg/L) (Gustafson et al. 1997)

- Concentration of naphthalene in gasoline: 0.5% or 0.5 g/100 g (or 3,695 mg/L) (Gustafson et al. 1997)

- Concentration of 1-methyl naphthalene in gasoline: 0.78% or 0.78 g/100 g (or approx. 5,760 mg/L) (estimated from Gustafson et al. 1997)

- Concentration of benzene in gasoline: 2.5% or 2.5 g/100 g (or 1.85×10^4 mg/L) (Hamilton 1996)

- Concentration of MTBE in gasoline: up to 15% or 15 g/100 g (or approx. 1.10×10^5 mg/L) (Hamilton 1996). (Note: MTBE concentrations in gasoline vary from state to state. Many states do not add MTBE.)

- Estimated emission of B(a)P in exhaust: 1080 µg/hr (from White and Carroll, 1998, using weighted average B(a)P emissions from two-cylinder, carbureted two-stroke liquid cooled snow mobile engine using gasoline and oil injected Arctic Extreme injection oil, 24-38:1 fuel:oil ratio. Weighted average based on percentage of time engine was in five modes of operation, from full throttle to idle).

- Estimated amount of B(a)P exhaust emissions retained in water phase = approximately 40% (based on value for B(a)P from Hare and Springier, quoted in North American Lake Management Society 2001).

Toxicity Benchmarks

A key part of the estimations is the water quality criterion, standard, or toxicological benchmark for each contaminant evaluated. There are no EPA water quality criteria for the protection of aquatic life for the PWC-related contaminants (EPA 1999b). There are, however, a limited number of EPA criteria for the protection of human health (via ingestion of water and aquatic organisms or ingestion of aquatic organisms only). Chronic ecotoxicological and human health benchmarks for contaminants were acquired from various sources.

Ecotoxicological benchmarks for benzo(a)pyrene, naphthalene, and benzene are from *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision* (Suter and Tsao 1996). The ecotoxicological benchmarks for benzo(a)pyrene (0.014 µg/L) and benzene (130 µg/L) are Tier II Secondary Chronic Values in table 1 of Suter and Tsao (1996), which were calculated using methods in the Great Lakes Water Quality Initiative (EPA 1993). The ecotoxicological benchmark for naphthalene (62 µg/L) is the EPA Region 4 chronic screening value (table 3 of Suter and Tsao 1996). This screening value was chosen for use as a conservative mid-range value considering the wide range of chronic values for naphthalene (12-620 µg/L) shown in Suter and Tsao (1996). The ecotoxicological benchmarks for 1-methyl naphthalene (19 and 34 µg/L) are based on LC_{50} values of 1900 and 3,400 µg/L for the marine invertebrate, Dungeness crab (*Cancer magister*), and the fresh water/estuarine fish, sheepshead minnow (*Cyprinodon variegatus*), respectively (USFWS 1987). The MTBE benchmarks of 18,000 and 51,000 µg/L are for marine and fresh water, respectively, and are based on the preliminary chronic water quality criteria presented in Mancini et al. (2002).

State water quality standards (including the numeric standards and descriptive text) must be reviewed and applied, as appropriate for each park being evaluated. The standards or criteria that fit the designated uses for the waters in the park must be used (for example, is it designated as a drinking water source or used only for support of aquatic life [fishing]?) This will determine which benchmarks are used: the “water

plus organism" benchmarks or the "aquatic organisms only" benchmarks. The correct benchmark must be used for either freshwater or marine/estuarine locations if there are different numbers provided for these two environments.

Following are the default toxicity benchmarks for the PAH, benzene, and MTBE having gasoline concentration information:

Chemical	Ecotoxicological Benchmark (µg/L)	Source	Human Health Benchmark[b] (µg/L)	Source
Benzo(a)pyrene	0.014	Suter and Tsao 1996	0.0044[b] 0.049[c]	EPA 1999a
Naphthalene	62	Suter and Tsao 1996	—	—
1-methyl naphthalene	19[a] 34[a]	USFWS 1987	—	—
Benzene	130	Suter and Tsao 1996	1.2[b] 71[c]	EPA 1999a
MTBE[d]	18,000 51,000	Mancini et al. 2002	13	CA DHS 2002

a. Based on LC_{50}s of 1,900 and 3,400 µg /L for Dungeness crab and sheepshead minnow, respectively (19 µg /L used for marine/estuarine calculations; 34 µg/L used for freshwater calculations).

b. Based on the consumption of water and aquatic organisms.

c. Based on the consumption of aquatic organisms only.

d. Ecotoxicological benchmarks, which are considered preliminary chronic water quality criteria, are 18,000 µg/L for marine and 51,000 µg/L for freshwater. There is no EPA human health benchmark, but the California Department of Health Services (2002) has established a primary maximum contaminant level (MCL) of 13 µg/L.

Example Calculations

Calculations of an example set of waterbody volume thresholds are provided below for the chemicals listed above together with their concentrations in gasoline and available toxicity benchmarks.

Loading to Water

Loadings of the five contaminants listed above are calculated for one day assuming 10 personal watercraft operate for four hours (40 PWC-hours), each discharging 11.34 L gasoline per hour and having concentrations in fuel or exhaust as listed.

Benzo(a)pyrene (from the fuel): 40 PWC-hrs × 11.34 L gas/hr × 2.07 mg/L = 939 mg

Benzo(a)pyrene (from the gas exhaust): 40 PWC-hrs × 1080 µg/hr × 1/1000 mg/µg × 0.40 = 17 mg

Total B(a)P = 956 mg

Naphthalene: 40 PWC-hrs × 11.34 L gas/hr × 3695 mg/L = 1.68×10^6 mg

1-methyl naphthalene: 40 PWC-hrs × 11.34 L gas/hr × 5764 mg/L = 2.62×10^6 mg

Benzene: 40 PWC-hrs × 11.34 L gas/hr × 1.85×10^4 mg/L = 8.39×10^6 mg

MTBE: 40 PWC-hrs × 11.34 L gas/hr × 1.10×10^5 mg/L = 4.99×10^7 mg

Loadings of contaminants from two-stroke outboards should be estimated based on the estimated loading based on the horsepower of the outboards involved (see "Assumptions and Constants" above) and the estimated hours of use, based on the types of boats and the pattern of use observed.

Threshold Volumes

Threshold volumes of water (volume at which a PWC- or outboard-related contaminant would equal the benchmarks listed above) are calculated by dividing the estimated daily loadings (mg of contaminant) for the number of operational hours (e.g., 40 PWC-hours) by the listed toxicity benchmark concentrations (µg/L), correcting for units (1 mg = 10^3 µg), and converting from liters to acre-feet (1 ac-ft = 1.234×10^6 L):

Protection of Freshwater Aquatic Organisms

Benzo(a)pyrene: 956 mg B(a)P $\times$ 10^3 µg/mg / 0.014 µg/L = 6.8×10^7 L or 55 ac-ft

Naphthalene: 1.68×10^6 mg naphthalene $\times$ 10^3 µg/mg / 62 µg/L = 2.71×10^7 L or 22 ac-ft

1-methyl naphthalene: 2.62×10^6 mg 1-methyl naphthalene $\times$ 10^3 µg/mg / 34 µg/L = 7.69×10^7 L or 62 ac-ft

Benzene: 8.39×10^6 mg benzene $\times$ 10^3 µg/mg / 130 µg/L = 6.45×10^7 L or 52 ac-ft

MTBE: 4.99×10^7 mg MTBE $\times$ 10^3 µg/mg / 51,000 µg/L = 9.78×10^5 L or 0.79 ac-ft

Based on these estimates and assumptions, 1-methyl naphthalene appears to be the contaminant (of those analyzed) that would be the first to accumulate to concentrations potentially toxic to freshwater aquatic organisms (i.e., it requires more water [62 ac-ft] to dilute the contaminant loading to a concentration below the toxicity benchmark). However, the threshold volumes are very similar for 1-methyl naphthalene, benzo(a)pyrene, and benzene.

Protection of Human Health

Benzo(a)pyrene: 956 mg B(a)P $\times$ 10^3 µg/mg / 0.0044 µg/L = 2.17×10^8 L or 176 ac-ft

Benzene: 8.39×10^6 mg benzene $\times$ 10^3 µg/mg / 1.2 µg/L = 6.99×10^9 L or 5,670 ac-ft

MTBE: 4.99×10^7 mg MTBE $\times$ 10^3 µg/mg / 13 µg/L = 3.83×10^9 L or 3,110 ac-ft (If the CA MCL of 13 µg/L for fresh water is used)

The California public health goal for MTBE is a drinking water–based MCL and is not as broadly applicable as the other criteria used in this analysis. However, it may be of interest, since MTBE is very soluble, and MTBE concentration could be an issue if the receiving body of water is used for drinking water purposes and MTBE is not treated. Using the numbers provided above, benzene would be the first PWC-related contaminant in these example calculations that would reach unacceptable levels in surface water; however, volatilization of benzene from water to air was not included in the calculation. MTBE would be the next contaminant to reach unacceptable concentrations. If human health water quality criteria for ingestion of aquatic organisms only were used for benzo(a)pyrene and benzene (0.049 µg/L and 71 µg/L, respectively), the corresponding threshold volumes would be 15.8 acre-feet and 95.8 acre-feet.

As a result of the estimated reductions in HC emissions (from the unburned fuel) in response to EPA regulations (listed above), additional personal watercraft and/or outboards may be used in the parks without additional impacts to water quality. For example, based on the expected overall reductions from the Environmental Protection Agency (1996a, 1997), up to twice the current number of personal watercraft/outboards may be used in a given area in 2012 without additional impacts to water quality over current levels. Effects on noise levels, physical disturbance, or hydrocarbon emissions that are products of combustion (e.g., B[a]P) may not be similarly ameliorated by the reduced emission regulations.

Application of Approach

Use of the approach described above for evaluating possible exceedance of standards or other benchmarks must be adapted to the unique scenarios presented by each park, PWC use, and waterbody being evaluated. *State water quality standards (including the numeric standards and descriptive text) must be reviewed and applied, as appropriate.*

Factors that would affect the concentration of the contaminants in water must be discussed in light of the park-specific conditions. These factors include varying formulations of gasoline (especially for MTBE); dilution due to mixing (e.g., influence of the thermocline), wind, currents, and flushing; plus loss of the chemical due to volatilization to the atmosphere (Henry's Law constants can help to predict volatilization to air; see Yaws et al. 1993); adsorption to sediments and organic particles in the water column (e.g., PAH), oxidation, and biodegradation (breakdown by bacteria). Toxicity of phototoxic PAH may be of concern in more clear waters, but not in very turbid waters.

The chemical composition of gasoline will vary by source of crude oil, refinery, and distillation batch. No two gasolines will have the exact same chemical composition. For example, B(a)P concentrations may range from 0.19 to 2.8 mg/kg, and benzene concentrations may range from 0 to 7% (2 to 3% is typical). MTBE concentrations will vary from state to state and season to season, with concentrations ranging from 0 to 15%. The composition of gasoline exhaust is dependent on the chemical composition of the gasoline and engine operating conditions (i.e., temperature, rpm, and oxygen intake). If site-specific information is available on gasoline and exhaust constituents, they should be considered in the site-specific evaluation. If additional information on the toxicity of gasoline constituents (e.g., MTBE) become available, it should be considered in the site-specific evaluation.

Lastly, results of the studies included in the collection of papers entitled "Personal Watercraft Research Notebook" provided by the NPS staff, can be used to provide some framework for your analysis. The following table summarizes some of the results presented in various documents on the concentrations of benzene, PAH, and MTBE.

POLLUTANT CONCENTRATIONS REPORTED IN WATER

Pollutant	Source(s)	Levels Found	
		"Lower Use" (e.g., open water, offshore locations; reduced motorized watercraft use)	**"Higher Use" (e.g., nearshore, motorized watercraft activity high)**
Benzene	*Lake Tahoe Motorized Watercraft Report;* several studies reported		
	1. U.S. Geological Survey	1. <0.032 µg/l	1. 0.13 – 0.33 µg/l
	2. Miller and Fiore	2. ≤0.3 µg/l	2. just over 1 µg/l
	3. University of California	3. <0.1 µg/l	3. 0.1 – 0.9 µg/l
PAH	A. Mastran et al.	A. All below detection limits (<0.1 µg/l for pyrene and naphthalene; <2.5 µg/l for B(a)P, B(a)A, chrysene)	A. Total PAH – up to 4.12 µg/l in water column; total PAH – up to 18.86 µg/l in surface sample at marina, with naphthalene at 1 µg/l; B(a)P – ≥2.3 µg/l
	B. Ortis et al.	B. Experiment #1 – 2.8 ng/l phototoxic PAH	B. Experiment #1 – ± 45 ng/l phototoxic PAH; 5–70 ng/L total PAH
MTBE	A. *Lake Tahoe Motorized Watercraft Report;* several studies reported		
	1. U.S. Geological Survey	1. 0.11–0.51 µg/l	1. 0.3–4.2 µg/l
	2. Miller and Fiore	2. ≤3 µg/l	2. 20 µg/l (up to approx. 31 µg/l)
	3. University of California	3. less than nearshore area	3. up to 3.77 µg/l
	4. University of Nevada – Fallen Leaf Lake	4. —	4. 0.7–1.5 µg/l
	5. Donner Lake (Reuter et al. 1998)	5. <0.1 µg/l	5. up to 12 µg/l (Dramatic increase from 2 to 12 µg/l from July 4 to 7)
	B. NPS, VanMouwerik and Hagemann 1999		
	6. Lake Perris	6. 8 µg/l (winter)	6. up to 25 µg/l
	7. Shasta Lake		7. 9–88 µg/l over Labor Day weekend
	8. Three-day Jet Ski event		8. 50–60 µg/l
	9. Lake Tahoe		9. often within range of 20–25 µg/l, with max of 47 µg/l

APPENDIX B: LETTER OF CONSULTATION

United States Department of the Interior
NATIONAL PARK SERVICE
Lake Roosevelt National Recreation Area
1008 Crest Drive
Coulee Dam, Washington 99116-1259

IN REPLY REFER TO:
W42

October 28, 2002

Memorandum

To: Interested Parties

From: Acting Superintendent, Lake Roosevelt National Recreation Area

Subject: Personal Watercraft Prescoping for Environment Assessment (EA)

This is a request for information or issues that should be addressed in an Environmental Assessment (EA) for continued use of personal watercraft at Lake Roosevelt National Recreation Area. The National Park Service is evaluating the effects of developing a special regulation providing for the continued use of personal watercraft within the national recreation area at Lake Roosevelt.

Please let us know of specific issues that the National Park Service should address as the draft EA is being developed. The draft EA will be issued within the next few months, at which time you will be able to comment on the proposed regulation. Your assistance in this matter is appreciated. If you have additional questions concerning this issue, please contact me at (509) 633-9441 ext. 123.

Daniel R. Mason

GLOSSARY

BTEX — benzene, toluene, ethylbenzene, and xylene

National Ambient Air Quality Standards (NAAQS) — Concentrations of criteria pollutants in ambient air (outdoor air to which the public may be exposed) below which it is safe for humans or other receptors to be permanently exposed. The *Clean Air Act* establishes two types of national air quality standards. **Primary standards** set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. **Secondary standards** set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

The EPA Office of Air Quality Planning and Standards has set national ambient air quality standards for six principal pollutants, which are called "criteria" pollutants. They are listed below. Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air ($\mu g/m^3$).

NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Standard Value[a]		Standard Type
Carbon Monoxide (CO)			
8-hour Average	9 ppm	(10 mg/m^3)	Primary
1-hour Average	35 ppm	(40 mg/m^3)	Primary
Nitrogen Dioxide (NO_2)			
Annual Arithmetic Mean	0.053 ppm	(100 $\mu g/m^3$)	Primary and Secondary
Ozone (O_3)			
1-hour Average	0.12 ppm	(235 $\mu g/m^3$)	Primary and Secondary
8-hour Average[b]	0.08 ppm	(157 $\mu g/m^3$)	Primary and Secondary
Lead (Pb)			
Quarterly Average	1.5 $\mu g/m^3$		Primary and Secondary
Particulate (PM_{10}) *Particles with diameters of 10 micrometers or less*			
Annual Arithmetic Mean	50 $\mu g/m^3$		Primary and Secondary
24-hour Average	150 $\mu g/m^3$		Primary and Secondary
Particulate ($PM_{2.5}$) *Particles with diameters of 2.5 micrometers or less*			
Annual Arithmetic Mean[b]	15 $\mu g/m^3$		Primary and Secondary
24-hour Average[b]	65 $\mu g/m^3$		Primary and Secondary
Sulfur Dioxide (SO_2)			
Annual Arithmetic Mean	0.03 ppm	(80 $\mu g/m^3$)	Primary
24-hour Average	0.14 ppm	(365 $\mu g/m^3$)	Primary
3-hour Average	0.50 ppm	(1300 $\mu g/m^3$)	Secondary

a. Parenthetical value is an approximately equivalent concentration.

b. The ozone 8-hour standard and the $PM_{2.5}$ standards are included for information only. A 1999 federal court ruling blocked implementation of these standards, which the Environmental Protection Agency proposed in 1997. The Environmental Protection Agency has asked the U.S. Supreme Court to reconsider that decision.

Nonattainment Area — A geographic region usually designated by an air quality planning authority through a formal rulemaking process within which one or more national ambient air quality standards are subject to violation. Sources of air pollutants in a nonattainment area are subject to more stringent requirements and controls than those in attainment areas (i.e., in areas where national standards are met).

Nonroad Model — An air quality emissions estimation model developed by the Environmental Protection Agency to estimate emissions from various spark-ignition type "nonroad" engines. The June 2000 draft of the nonroad model was used to estimate air pollutant emissions from personal watercraft. It is available at <http://www.epa.gov/otaq/nonrdmdl.htm>.

Personal Watercraft (PWC) — As defined in 36 CFR 1.4(a) (2000), refers to a vessel, usually less than 16 feet in length, which uses an inboard, internal combustion engine powering a water jet pump as its primary source of propulsion. The vessel is intended to be operated by a person or persons sitting, standing, or kneeling on the vessel, rather than within the confines of the hull. The length is measured from end to end over the deck excluding sheer, meaning a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, and similar fittings or attachments, are not included in the measurement. Length is stated in feet and inches.

SUM06 — The cumulation of instances when measured hourly average ozone concentrations equal or exceed 0.06 part per million (ppm) in a stated time period, expressed in ppm-hours.

Thermocline — The region in a thermally stratified body of water that separates warmer, oxygen-rich surface water from cold, oxygen-poor deep water. In a thermocline, temperature decreases rapidly with depth.

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CARB	California Air Resources Board
CDHS	California Department of Health Services
CPFPWS	Coalition of Parents and Families for Personal Watercraft Safety
FFWCC	Florida Fish and Wildlife Conservation Commission
IWL	Izaak Walton League of America
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NTSB	National Transportation Safety Board
ODEQ	Oregon Department of Environmental Quality
PWIA	Personal Watercraft Industry Association
USGS	U.S. Geological Survey

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-115 (April 2003)

Off-Road Mobile Source Emission Reduction Program

Recreational Marine Vessels

This page updated July 31, 2002.

ARB's recreational marine engine program is an important new element in ARB's efforts to improve air quality through reductions of hydrocarbon (HC) and oxides of nitrogen (NOx) emissions. Regulations have been adopted for certain marine vessels and regulations have been proposed for other spark-ignition engines used in boats for propulsion. Commercial marine engines are covered under the Commercial Marine Vessel web page. Spark-ignition auxiliary marine engines (power generators, winches, or auxiliary propulsion engines for sail boats) are defined as small off-road spark-ignition engines (below 25 horsepower) or large off-road spark-ignition engines (25 horsepower and greater) depending on their size. Compression-ignition auxiliary and propulsion marine engines under 50 horsepower are defined as off-road diesel (compression-ignition) engines.

Boat engines are divided into classes of outboards or inboards. Outboard engines are those which are mounted external to the boat structure. They typically hang on the rear wall of the boat. To minimize their weight, outboard engines have traditionally been two-stroke engines, thus personal watercraft (PWC) , which are most commonly two-stroke jet-drives, are grouped together with them. Inboard engines are those which are situated completely within the confines of the boat hull. Inboard boat drive types can be straight propeller-shaft, vee-drive, sterndrive, (also called inboard-outboard), or jet-drive. Inboard engines are automotive engines adapted for use in boats.

In 1998, the Board approved emission reductions from outboard engines and personal watercraft by adopting exhaust emission standards for new engines. Starting in 2001, all new outboards sold in California will be required to meet the U.S. EPA 2006 emission levels (approximately 75 percent reduction from uncontrolled levels).

The ARB has recently adopted emission regulations for new spark-ignition inboard engines.

Emission from recreational marine compression-ignition engines are the subject to of an Advanced Notice of Proposed Rulemaking (ANPRM) by the U.S. EPA (65 FR 76797, December 7, 2000). The standards are likely to be similar to the commercial marine diesel standards of 40 CFR Part 94. For more information regarding this federal regulation please see U.S. EPA's Office of Transportation and Air Quality web site.

Certification Requirements and Guidelines - on-line access to relevant certification guidance documents for all spark-ignition marine manufacturers.

MARINE SPARK-IGNITION INBOARD RULEMAKING:

At its July 26, 2001 public hearing, the Board approved, with modifications, the staff's regulatory proposal

for inboard gasoline boat engines. Beginning with the 2003 model year, inboard engines introduced into California will be required to meet exhaust emission standards, certification test procedures, new-engine and in-use compliance provisions, consumer provisions such as environmental labeling, and warranty requirements.

On January 3, 2002, the Notice of Modified Text was made available to the public for comment. This document contains the modifications from the staff's original proposal, which was released to the public on June 8, 2001. Links to this and other related documents can be found below.

- Mailout MSC 02-01: Notice of Public Availability of Proposed Modified Text for 2003 and Later Spark-Ignition Sterndrive and Inboard Marine Engines *(added January 3, 2002)*

- Formal Regulatory Documents: Proposed Regulations for 2003 and Later Spark-Ignition Sterndrive and Inboard Marine Engines, including Staff Report and Test Procedures. *(updated January 3, 2002)*

- Mailout MSC 01-09: Public Hearing Notice regarding Proposed Regulations for 2003 and Later Spark-Ignition Sterndrive and Inboard Marine Engines *(added June 11, 2001)*

- Agenda for March 15, 2001 Marine Regulatory Meeting

- Public Workshop September 19, 2000 (Available Soon)
  - Workshop Notice
  - ARB Presentation
  - NMMA Presentation
  - Mercury Marine Presentation
  - Sierra Research Presentation

OUTBOARD/PWC GENERAL INFORMATION:

The new California regulation requires that new outboard and PWC engines meet the U.S. EPA 2006 standards for hydrocarbon (HC) plus oxides of nitrogen (NOx) in 2001. This level represents about a 70 percent reduction in HC emissions from the pre-1998 levels. In addition, the California regulation adds a very-low-emission tier for 2004 of about 77 percent reduction from pre-1998 levels, and an ultra-low-emission level for 2008 and later of about 90 percent reduction.

The new regulation also sets emission parts warranty requirements, consumer label requirements, (which enable the purchaser to readily identify the new cleaner compliant models, and the inherently lower-emitting 4-stroke models), and production line and in-use testing requirements.

- Proposed Watercraft Labeling (added July 29, 1999) - Frequently Asked Questions
- Letter from Chairman Lloyd to Californians United for Boating (Word - 132K) or (Acrobat - 51K)
- New Regulations for Gasoline Marine Engines Fact Sheet - (Acrobat - 27K)
- New Standards for Cleaner Watercraft - Frequently Asked Questions
- What Every Boat Owner Should Know - Cleaner Air & Water in 2001 (Acrobat - 27K) or (HTML)
- ARB Acts to Reduce Marine Engine Pollution - News Release
- Formal Regulatory Documents: These documents include, but are not limited to, the staff report, regulations, test procedures, and 15-day notice(s).

Where Can I Get More Information?

For more information, please call Jackie Lourenco at (626) 575-6676 or via e-mail at jlourenc@arb.ca.gov.

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Mobile Source Program
Off-Road Emission Reduction Program

A department of the California Environmental Protection Agency

California Department of Health Services

Drinking Water Monitoring for MTBE

Last Update: April 2, 2003

Methyl tertiary butyl ether (MTBE), a gasoline additive, is a **regulated drinking water contaminant** in California. It has:

- a primary maximum contaminant level (MCL) of 13 micrograms per liter (µg/L), effective May 2000, that addresses **health concerns** — its **public health goal** is also 13 µg/L
- a secondary MCL of 5 µg/L, effective January 1999, that addresses concerns about **taste and odor**
- a **detection limit for purposes of reporting** (DLR) of 3 µg/L. The DLR is the level at which DHS is confident about the quantity being reported.

Analytical results from 3,502 public water systems have been reported for 11,310 sources, where "sources" may include both raw and treated sources, distribution systems, blending reservoirs, and other sampled entities. MTBE at or greater than the DLR was reported in 71 sources (see footnote a in the following table). MTBE at any concentration was reported in 96 sources (see **results update**).

The 3,502 systems serve 32 million of the state's 35 million people, about 91% of the state's population.

MTBE in Drinking Water Sources (Year Initially Detected) [a,b]

MTBE concentration	prior to 1995 [c]	1995	1996	1997	1998	1999	2000	2001	2002	2003	No. of Sources	No. of Systems	No. of Counties
> 13 µg/L	2	2	2	6	2	1	2	4	1	1	23	18	12
> 5 µg/L	2	3	5	5	6	4	6	8	6	1	46	34	20
= or > 3 µg/L [d]	2	3	5	5	13	8	13	12	10	0	71	48	28

[a] Data are draft (they may change with subsequent updates). These values are derived from **sources reporting more than one MTBE detection**, and they do not include agricultural wells, monitoring wells, or more than one representation of the same source (*e.g.*, a source with both raw *and* treated entries is counted a single source)
[b] As of April 1, 2003
[c] 1989 and 1990
[d] Detections have been most numerous in the counties of Los Angeles (17 sources), San Diego (6), Kern (6), El Dorado (5), and San Francisco (3)

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STATISTICS

- 76% of all PWC accidents in 1998 were collisions—70% with other vessels, and 6% with fixed objects[1]
- With Exposure Hours factored in, PWC are 6 times more likely to be involved in an injury accident than an open motor boat[2]
- PWC injury accidents are significantly under-reported Data captured through the National Electronic Injury Surveillance System shows that between 1990 and 1995 an estimated 32,954 persons with PWC-related injuries were treated in US hospital Emergency Departments, of which 3.5% were hospitalized. PWC-related injuries increased from an estimated 2860 in 1990 to more than 12, 000 in 1995. During that same 5-year period, the number of PWC in operation increased 3 times, and the number of injuries increased 4 times. The rate of ED-treated injuries related to PWC was about 8.5 times greater than the rate from motorboats.[3]

Discussion of Statistics as a mode of determining what education is needed:

An argument has been made that statistics can be manipulated for the purposes of the manipulator. No doubt that is true. Let us look at the motives of persons who have gathered and disseminated the statistics reported above.

1. The US Coast Guard.

   Q. What could be their motive in reporting the high statistic on PWC collisions? Where did they get those numbers?

   A. The US Coast Guard is the central reporting agency, which gathers boating accident information from all 50 states. The Coast Guard Safety office analyses the data reported and makes safety recommendations to marine manufacturers, and when necessary intervenes on behalf of the consumer to insure the boating public's safety. The Coast Guard is heavily

Questions

involved in search and rescue operations and is very familiar with accident scenarios. Motive? Save lives.

2. Heiden & Associates: Hired by Kawasaki, Polaris, and Yamaha to survey the boating public. Analysis and data supplied to the USCG.

   Q. How did they decide what a boating exposure hour is for a PWC or an open motorboat?

   A. Riding time included time away from the dock, shore, or launch point for both PWC and open motorboat. 60 percent of total open motorboat time was spent in operation, and 77 percent of PWC time was spent in operation. Motive: Try to understand what the real risks of accident were from vessels reporting similar exposure hours. Possible secondary motive: Hope to show PWC operation was not that risky. (Unhappily, not so.)

3. Branche et. Al. Emergency Department and other Health Officials.

   Q. Are they trying to make PWC look bad? Why does their report differ so much from the USCG?

   USCG stats for 1995 show only 3,986 PWC injuries. The ER Docs are saying 12,000—that makes USCG stats only ¼ the number seen in the ER. What gives?

   A. The Coast Guard is not everywhere at once, and some people don't want to get "in trouble" so they don't fill out an accident report, even though it is required. As for the ER Docs, there are strict penalties for falsifying medical records. There is no reason to suspect a conspiracy by doctors who treat trauma. Instead, maybe we should suspect a need to reverse the growing trend in PWC accidents so they don't have to go home so often thinking about the carnage they have seen. Motive? Prevent Accidents.

4. The Coalition of Parents and Families for Personal Watercraft Safety

Q. Why put out all this "negative" stuff about PWC? Are you sure you don't want to ban them?

A. There are many entities now involved in the PWC Safety Discussion. At least one study has been ordered and then pulled because of misconduct, which might have shed light remedies for loss of steering off throttle. At least two years were wasted, almost 300 people died in that time on PWC, and 17,000 injuries were reported to the USCG. (No continual tracking system is in place in Emergency Departments, so unless someone else funds a similar study to Branche et. Al. we will not see new material.) We cannot afford to wait while more people are injured and killed. It will be a nice day when we have a dramatic downturn in PWC injuries and deaths to report, and when that downturn stays consistent. OK if it makes you mad, but better if it makes you take a boater education class, and exercise caution at all times while operating PWC while the "powers that be" get all the legal and technical stuff worked through. That looks like years, and even when the design is changed to include real off-throttle steering, we will continue to have challenges with proper safety gear, appropriate training for the type and speed capabilities of the craft, and appropriate age and training of all PWC operators. We are here for the long term. Yes, we're sure we don't want to ban them. If we get on that bandwagon, nobody who likes PWC will talk with us, work with us, or assist us in saving lives and preventing injuries. Motive: Save lives, prevent injuries.

A final word about statistics. If you want to seriously look at a problem with prevention in mind, you have to study the problem, taking in all the information you can. The best information we have is not complete, but it is the best information we have. Rather than quibble over the unhappy news that PWC represent disproportionate numbers of collisions and trauma on accident reports; let's give some credence to the information that we have. People are more than statistics—they are wonderfully made, and completely irreplaceable.

[1] 1998 USCG Boating Statistics

[2] 1997 Boating Exposure Survey Results. Heiden Associates, Inc.
PWC incidence per million exposure hours: 6.22, Open Motorboats: 0.94; Canoes/Kayaks 0.25. This statement is qualified with the caution that when interpreting these observations because of incomplete reporting of injuries and potentially significant differences in injury reporting rates across vessel types.

[3] A Growing Public Health Concern. Christine M. Branche, PhD; Judith M. Conn, MS, MBA; Joseph L. Annest, PhD. JAMA, August 1997.

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